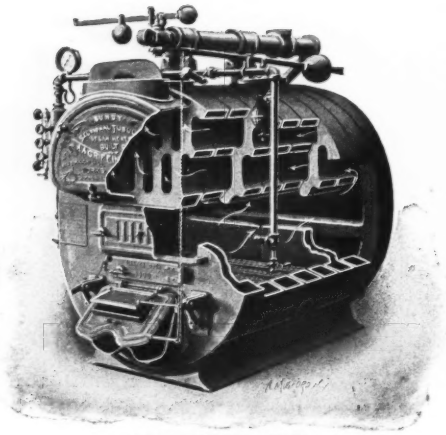
Domestic Engineering

CHRISTMAS 1900

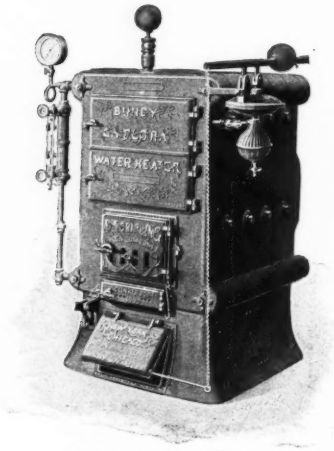
VOL. 20 Nº 3 DECEMBER 20. Nº 134

Gollings

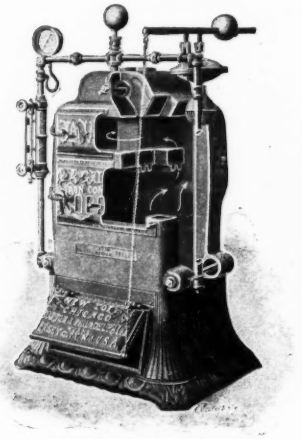
BUNDY Steam & Hot Water BOILERS AND RADIATORS



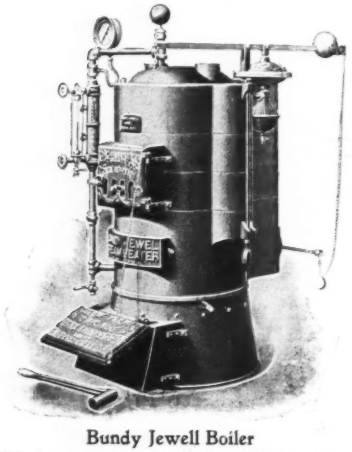
Bundy Tubular Boiler
Made in 72 styles and sizes from 350 to 5,500 sq. ft. for Steam and 575 to 10,000 sq. ft. for Water.



Bundy La Flora Boiler
Made in 60 styles and sizes from 300 to 2,400 sq. ft. for Steam and 500 to 2,150 sq. ft. for Water.

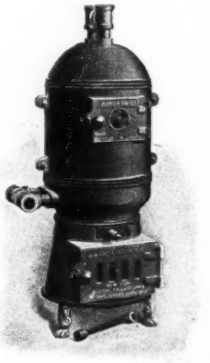


Bundy La Villa Boiler
Made in 24 styles and sizes from 200 to 800 sq. ft. for Steam and 325 to 1,300 sq. ft. for Water.



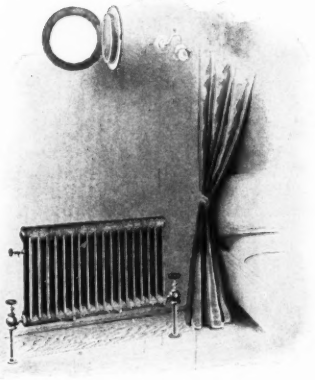
Bundy Jewell Boiler
Made at present in 4 sizes 400 to 450 sq. ft. for Steam and 650 to 750 sq. ft. for Water. Patterns for 12 other sizes being made.

Also made in 3 Different Sizes for Steam.

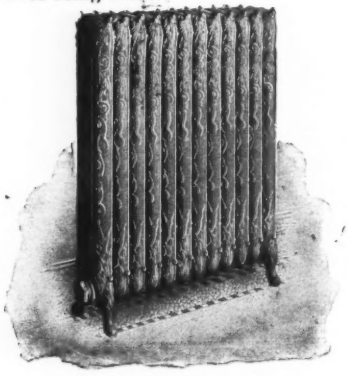


For Steam 125, 150 and 200 sq. ft. Capacity.

Bundy Daisy Tank Heater
Our Daisy and La Villa Tank Heaters are made in 9 sizes from 195 to 1i300 gallons per hour capacity.



Bundy State Room Radiator
Made in 5 and 7 square feet sections, to set vertical or horizonal.

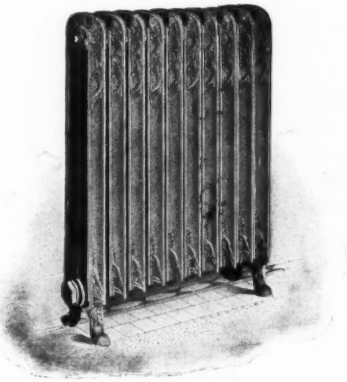


Bundy Elite Radiator

Send for new catalogue DE, and, before ordering elsewhere, get our prices. You may find that you can save considerable money by ordering of us.

A. A. GRIFFING IRON CO.

NEW YORK, - - 66-68 Centre Street
BOSTON, - - 177-179 Fort Hill Sq.
PHILADELPHIA, - 382 Bourse Bldg.
Works: JERSEY CITY, N. J.



Bundy Columbia Radiator

We manufacture 16,000 different sizes and styles of Raditors, being a line unequalled by any other concern in the world.

DOMESTIC ENGINEERING

Whole Number 134 *Chicago and New York, December Twentieth, Nineteen Hundred* *Vol. 20, No. 3*

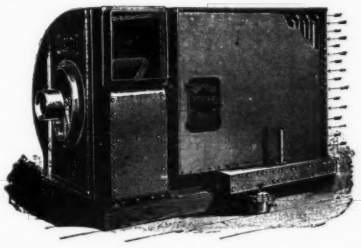
PENN RADIATOR COMPANY, CORRY, PA. INDIRECT—DIRECT DIRECT INDIRECT RADIATORS

NEW YORK, BOSTON, MINNEAPOLIS, DENVER, PHILADELPHIA, ST. LOUIS, LONDON, HAMBURG **AMERICAN RADIATOR CO.** GENERAL OFFICES LAKE & DEARBORN STS. CHICAGO.

U.S. RADIATOR CO.

Home Office DUNKIRK, N. Y. And Foundry

TRITON .·. .·. CHAUTAUQUA



Buffalo FAN SYSTEM OF HEATING & VENTILATING ALL LARGE BUILDINGS. BUFFALO FORGE CO.

F. E. Cudell's PATENT sewer gas and back-water **trap**

for wash bowls, sinks, bath and wash tubs

Put into the White House by the U. S. government For venting use vent trap.

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GOBEILLE PATTERN CO. Cleveland, O.

MANTLE CHEMICALS
The Roessler & Hasslacher Chemical Co.
Office: 100 William St., New York
Chicago Office: 16 N. Clark St.

See our Advertisement...Page 59

WHAT A DIFFERENCE
In the quality of Plumbing work.
RAYMOND'S

COMBINATION FERRULES MAKE RELIABLE CONNECTIONS BETWEEN LEAD AND IRON PIPES.

WHY?

Because they have an extra thickness of lead over the shoulder, giving strength where it is needed, and where other Lead Ferrules are weak.

The genuine article bears our label.

RAYMOND LEAD COMPANY, CHICAGO.

UNIONTOWN ACME RADIATOR CO.
UNIONTOWN, PA.
MANUFACTURERS OF
STEAM AND HOT WATER RADIATORS

JENKINS' IMPROVED AUTOMATIC AIR VALVES
Suitable for high or low pressure. Take no more room than an ordinary air cock. Endorsed by the leading steam experts as the best made and the quickest working. All genuine stamped with our Trade Mark.
JENKINS BROS., New York, Boston, Chicago, Philadelphia

WE MAY REGRET
having to rest our large store buildings on first stories of glass, but large show windows are an imperative requirement. To light them perfectly at night use my special patent store-window reflector. Particulars on request.
I. P. FRINK, 551 Pearl St., N. Y. City

WATER SUPPLY BIG VOLUME **LIFTS**
L. E. RHODES CO. HARTFORD, CT.

LAWLER'S MODERN PLUMBING
MOST PRACTICAL BOOK EVER WRITTEN. PRICE $5.00
DOMESTIC ENGINEERING, CHICAGO, ILL.

The Pattern Shop of the East
H. B. OLMSTEAD & CO.
87 FRANKFORT ST NEW YORK

SEE OUR HEATER PAGE 4 **ADV.**
ISAAC A. SHEPPARD & CO., - PHILADELPHIA

STOVE PIPE WATER HEATER $15.00 **FURNACE HELPER $25.00**

THE STOVE PIPE WATER HEATER goes in any stove pipe and with the waste heat warms water for tank, bath, kitchen, stock or laundry, or with radiator an extra room. THE FURNACE HELPER goes in smoke pipe of furnace steam or hot water boiler and will warm rooms furnace cannot. It furnishes hot water from the heat which goes up the chimney. Sent on two weeks trial. Our REGURGITATING SAFETY VALVE, $10., can be attached to any hot water plant, old or new. It prevents boiling over, makes radiators do a half more work. If you are in trouble send for one. Ask for booklet "How to Utilize Waste Heat" or send money with order. Agents Wanted.
ANDREWS HEATING COMPANY, 1208 GUARANTY BUILDING, MINNEAPOLIS, MINN., U. S. A.

PENN RADIATOR COMPANY, CORRY, PA. INDIRECT—DIRECT DIRECT INDIRECT RADIATORS

The Grand Prix

Highest Possible Award—higher than gold,
silver or bronze medals or honorable mention

and the ONLY Grand Prix Given

at the

Exposition Universelle
Paris, 1900

on Radiators and House Heating Boilers to any Heating Apparatus Manufacturer in the World was awarded to

AMERICAN RADIATORS

AND

IDEAL BOILERS

MADE BY

AMERICAN RADIATOR COMPANY

Chicago Boston Philadelphia Minneapolis New York Buffalo St. Louis Denver

IN COMPETITION WITH THE ENTIRE WORLD.

THE ONLY

GOLD MEDAL

GIVEN AT THE

PARIS EXPOSITION, 1900

FOR EXHIBITS OF

VALVES AND FITTINGS

WAS AWARDED TO

NEW YORK
PHILADELPHIA
CINCINNATI
KANSAS CITY
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CRANE CO.

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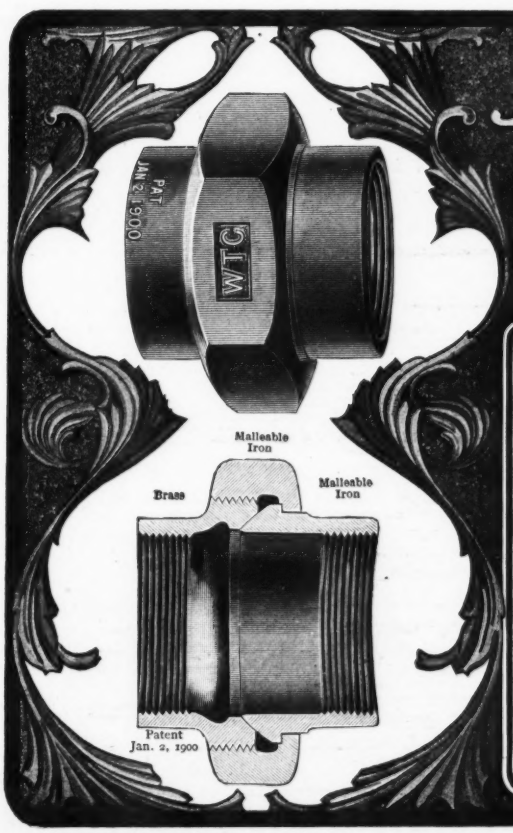
ESTABLISHED 1855

ST. PAUL
ST. LOUIS
LOS ANGELES
SAN FRANCISCO
PORTLAND, ORE.

WRITE FOR POCKET CATALOGUE



A UNION WITH NO GASKET

Will not Rust.

"The Kewanee"

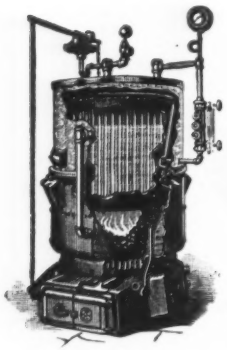
It is removable

the joint being easily disconnected because of the different metals (brass and iron) employed. Write for circular.

MANUFACTURED BY

Western Tube Co.

Kewanee, Ill.



Hard Coal Boiler.

The Gorton Side Feed Boilers

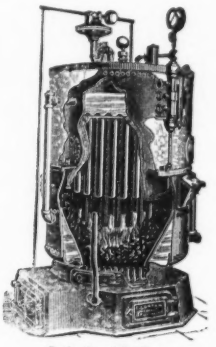
You want the best, We have it.

FOR STEAM AND HOT WATER HEATING.

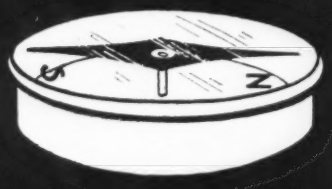
Send for Catalogue and Investigate for Yourself.

96 Liberty Street, New York. Old Colony Bldg. Chicago.
77 Oliver Street, Boston, Mass. Prudential Bldg. Atlanta, Ga.

GORTON & LIDGERWOOD CO.



Soft Coal Boiler.



THE COMPASS

which points invariably toward sure and lasting profits is the **Paragon Steam Generator.** If used rightly it will guide you to a bigger and better business than you have ever done before. Steer your business by the Paragon if you want to reach the most profitable harbor.

Paragon is also the name of the best Hot Air Furnace made.

ISAAC A. SHEPPARD & CO.,

NEW YORK, PHILADELPHIA, BALTIMORE.

Holland Radiators...

Chicago Office, 38 Dearborn Street.
Denver, Colo., Office, 1759 Stout Street.
Works, Bremen, Indiana.

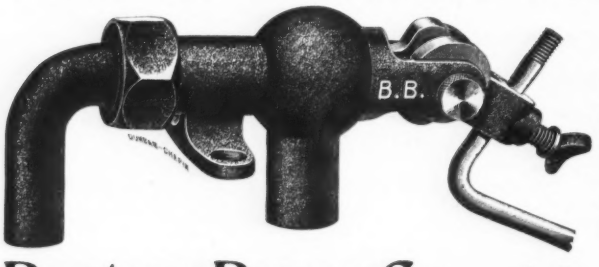
Kansas City, Mo., Agents, U. S. Water & Steam Supply Co.
Cleveland, Ohio, Agents, The George Worthington Co.

At above points a complete line of our Bremen--Reliance--Eclipse and Unique Radiators are carried.

Permit us to demonstrate how well we can serve you. . . .

HOLLAND RADIATOR COMPANY.

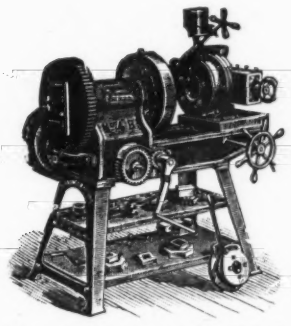
THE B. B. HIGH-PRESSURE BALL COCK



THE SIMPLEST AND BEST COCK EVER MADE.

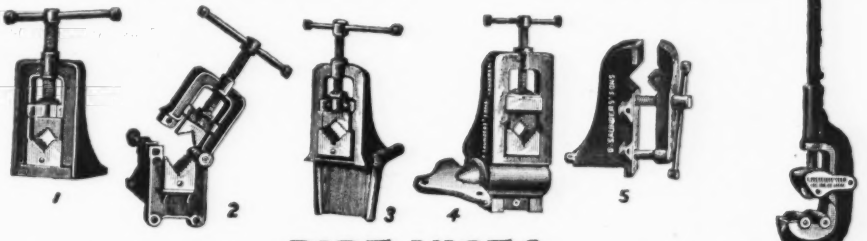
No special packing required. Ground joint coupling which is always tight. Roller bearing lever on cam, reducing friction to lowest amount. No hammering, no singing or whistling. Has only one packing which is easily removed. Removable seat of best steam metal. We are making Floats stamped with our B. B. which are throughly guaranteed. Ask your jobbers for them.

Boston Brass Co., 36 & 40 Oliver St., Boston, Mass.



No. 4 B. Pipe Cutting and Threading Machine, ⅛ inch to 4 inches Hand or Power.

D. SAUNDERS' SONS



Manufacturers of Improved **PIPE VISES** of all Styles and Sizes

Holding one-eighth to eight inch pipe, made of malleable iron cast iron and steel. Also **Pipe Threading Machines** ⅛ to 16-inch; Hand Pipe Cutters, Stocks and Dies, Tapping Machines, etc.

SEND FOR CATALOGUE. **35 ATHERTON STREET, YONKERS, N. Y.**

If we will sell you a 350 ft. Water Boiler at $8.10 less than others; a 550 ft. Boiler at $14.00 less, and an 850 ft. Boiler at $19.50 less and guarantee it will do as much or more work than any other other Boiler which has the same size grate, isn't it good business for you to find out about it?

Perhaps you have a strong competitor who gets most of the business in town, on the prestige attached to the name on the Boiler he handles.

If ours is a better Boiler, can't you tell why it is better and sell it on its **real worth**, instead of on the sentiment attached to the name?

Some wide awake dealers have discontinued paying a large price for a manufacturer's name, they have established their **own** name by selling goods on their merits.

The best and most economical advertising is selling the best article for the least money.

You can do a large business with a very small newspaper space if you prove to a few customers your prices are less for a really good article.

Your money back for the asking if our goods are not what you **expected them to be.**

DIGHTON FURNACE COMPANY, TAUNTON, MASS.

Send Us Your Orders for

We guarantee prompt shipment

Lead Pipe
Sheet Lead
Solder
Lead Traps
Lead Bends
Combination Ferrules and Soldering Nipples
Bi-Metallic Traps, etc.

We guarantee lowest market prices

Sportsman's Shot Works, Cincinnati

Two Great Wrenches

The "TRIUMPH" and The "ALLIGATOR"

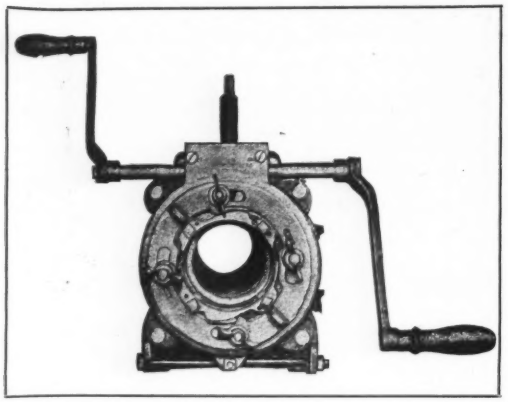
Never loses its grip or its handle.
Never crushes or locks on the pipe.
Can be used as a monkey-wrench or pipe-wrench.

The Original. Always ready.
The Reliable. Always positive.
The Genuine. Never slips.

Write for circulars and prices and mention DOMESTIC ENGINEERING

American Saw Co.

TRENTON, N. J.



Combination Vise
and
Screw Cutting Machinery

SAVES TIME AND MONEY
SEND FOR CATALOG AND PRICES

HICKMAN-MELHORN CO.
200-208 Liberty Ave., PITTBURG, PA.

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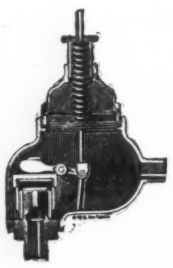
The Policy of this Journal

WE believe success—long continued, permanent success—can only be achieved in the newspaper business by conducting it in the same way a man builds a good reputation—it must have character back of it, and character, a strong character, must be based on honest intention. We all slip up in fulfillments, but good intent is necessary if good fulfillment ever comes. Our intent is to print the best trade journal in the world, in the best way, seeking for the best result. If you think we are falling short of the mark, in the interest of good results, please let us know.

DOMESTIC ENGINEERING,
JNO. K. ALLEN, President.



The G. McG. Manufacturing Co.

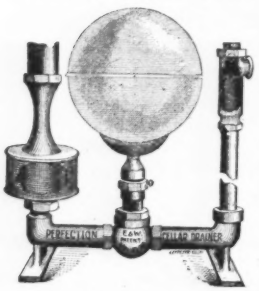
::: Manufacturers and Patentees of the :::
G. McG. REGULATOR, HOPPER
VALVE AND URINAL SPRAY

W. U. GRIFFITHS
A. McGUCKIN

No. 1015 Christian Street
PHILADELPHIA PA.

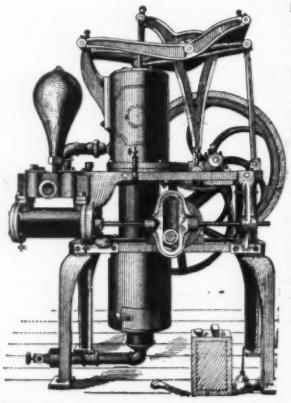
We Want You

When in th e market fo



Hot Air Pumping Engines
Hydraulic Pumps
or
Cellar Drainers

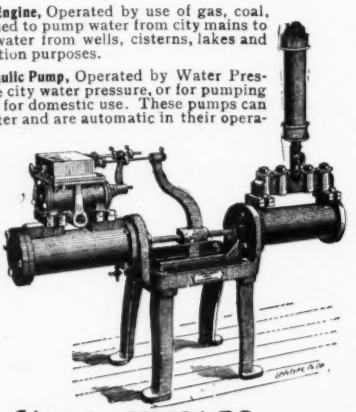
to let us tell you about our devices and quote prices



Erwin-Welch Hot Air Pumping Engine, Operated by use of gas, coal, gasoline or kerosene oil. Used to pump water from city mains to roof tanks or for pumping water from wells, cisterns, lakes and rivers for domestic or irrigation purposes.

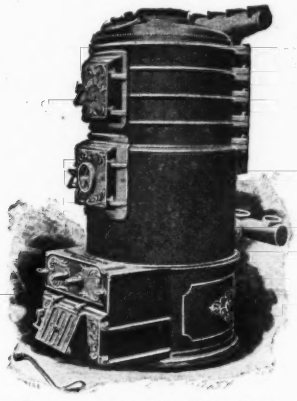
Erwin-Welch Automatic Hydraulic Pump, Operated by Water Pressure Only. Used to increase city water pressure, or for pumping water from wells or cisterns for domestic use. These pumps can be used without wasting water and are automatic in their operation. Built in 25 sizes.

Our Perfection Cellar Drainer Is operated by water or steam pressure. Used to force out water that may accumulate in Cellars, Wheel Pits, Foundation, Ditch and Pit Excavations, etc. The Drainer stops and starts automatically. Is the strongest, most durable and most efficient made.



Descriptive Circulars Sent Upon Request

ERWIN & WELCH, Manufacturers, 35 and 37 S. Canal Street, CHICAGO



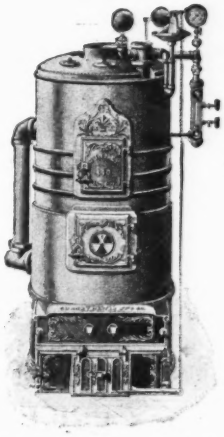
Gurney 400 Series Hot Water Heater.

Gurney

HOT WATER HEATERS
Steam Boilers
AND
RADIATORS

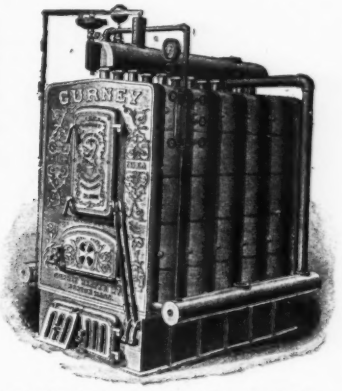
Represent **Progression** and **Advancement** in the Manufacture of Successful **Heating Apparatus.**

SOLD ONLY THROUGH THE TRADE.



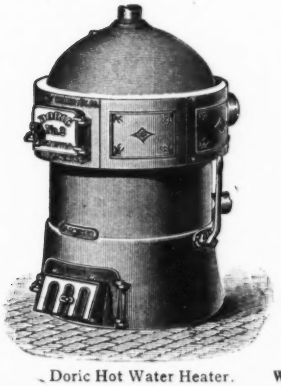
Gurney 400 Series Steam Boiler.

THE STANDARD OF THE WORLD for their Respective Requirements.



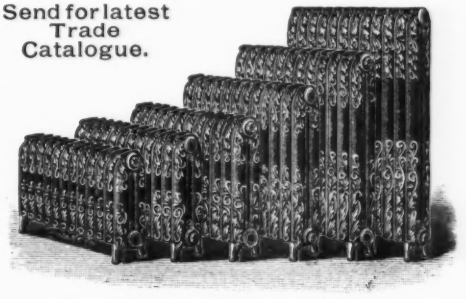
"Bright Idea" Steam Boiler, Sectional View.

For Durability, Efficiency and Economy, They Continue To Be Unsurpassed.



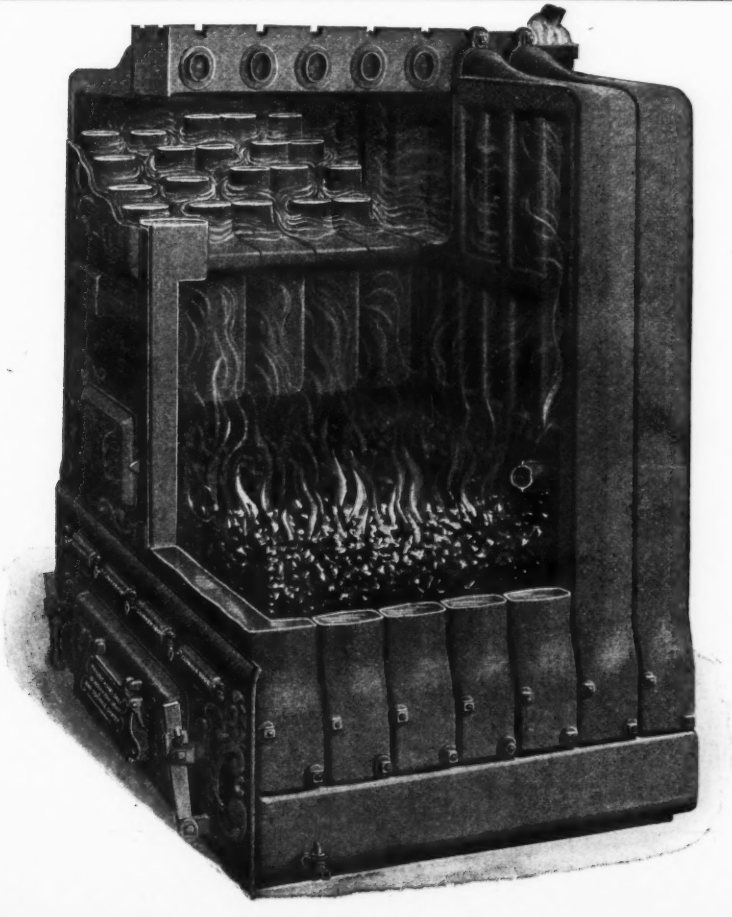
Doric Hot Water Heater.

Send for latest Trade Catalogue.



Duet Radiators for Hot Water and for Steam.

GURNEY HEATER MFG., CO.
74 Franklin St., Cor. Arch, BOSTON, MASS.
New York Branch: 111 Fifth Ave., cor. 18th St., N. Y.
Western Selling Agents: JAMES B. CLOW & SONS, 222-224 Lake St., Chicago.



Henderson Heaters

HAVE A SPECIAL DEVICE FOR

Burning the Gases

which commonly go unburned to the chimney. Without this device these heaters are equal to any made.

WITH IT THEY STAND ALONE.

The Prizer-Painter Stove and Heater Co.

READING, PA.

34 NORTH CANAL STREET
CHICAGO

284 AND 286 PEARL STREET
NEW YORK

PATENTED Dec. 9, 1890.
Feb. 2, 1892. June 14, 1892.
Other patents pending.

VACUUM VALVE No. 7

PERFECTED=DUPLEX

Steam Air Valve will automatically vent the radiator of the air, close by

FLOTATION AGAINST WATER and by **EXPANSION AGAINST STEAM**

After the air has been expelled from the radiator the **vacuum feature,** in the **top part of the valve,** is brought into service by the **phosphor bronze ball seating itself** so as not to permit any air to enter into the radiator through the valve, thus causing a vacuum, thereby necessarily **reducing consumption of fuel,** and with the valuable feature of locked shield which prevents tampering, must appeal to every user.

The **radiation surface** is **entirely heated,** which a steam heating **contractor will appreciate,** where contracts stipulate degree of temperature required.

PRICE, $2.00 EACH

Manufactured by *Monash-Younker Co.*

203 S. CANAL STREET CHICAGO

43 CENTRE STREET NEW YORK

Never Fails to give Satisfaction.

Sectional view, with base, showing no obstructions to perfect ventilation

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VENTILATOR

Designed upon scientific principles for

MILLS, FACTORIES, SCHOOLS, CHURCHES, PUBLIC BUILDINGS, ETC.

Made Right **Sold Right**

AND IS THE BEST VENTILATOR ON THE MARKET.

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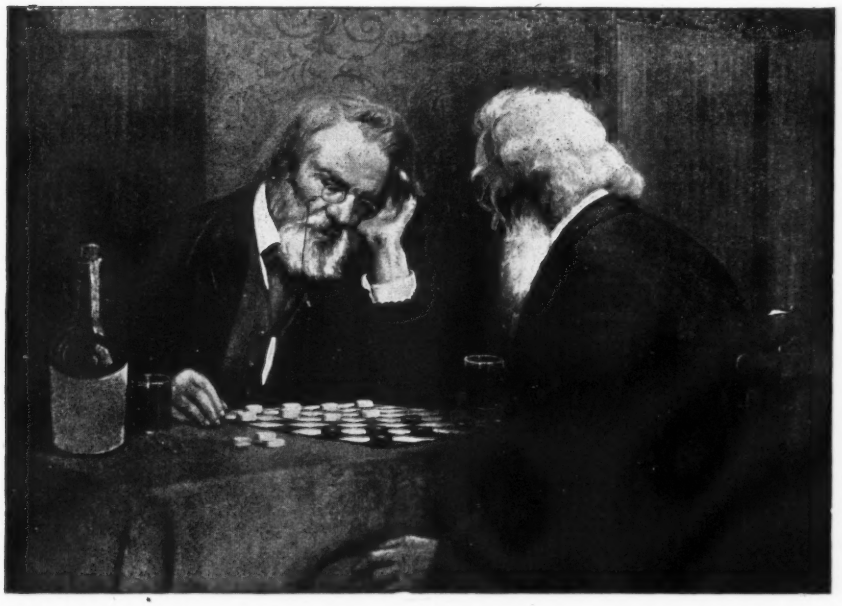

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Grand Prix & Two Gold Medals

COLUMBIAN UNIVERSITY

WASHINGTON, D. C., October 15, 1900.

DEAR SIR:

I am instructed by Commissioner-General Peck to inform you that you have been awarded the Diploma of **A Grand Prix** for your exhibit in Class 69, at the International Exposition, Paris, 1900.

[Signed] J. H. GORE,
Juror-in-Chief.

COLUMBIAN UNIVERSITY

WASHINGTON, D. C., October 15, 1900.

DEAR SIR:

I am instructed by Commissioner-General Peck to inform you that you have been awarded the Diploma of **A Gold Medal** for your exhibit in Class 111, at the International Exposition, Paris, 1900.

[Signed] J. H. GORE,
Juror-in-Chief

UNITED STATES COMMISSION

To the Paris Exposition of 1900

DEPARTMENT OF EDUCATION AND SOCIAL ECONOMY

20, Avenue Rapp, Paris, France, October 24, 1900.

Standard Mfg. Co., Pittsburg, Pa.

DEAR SIRS:

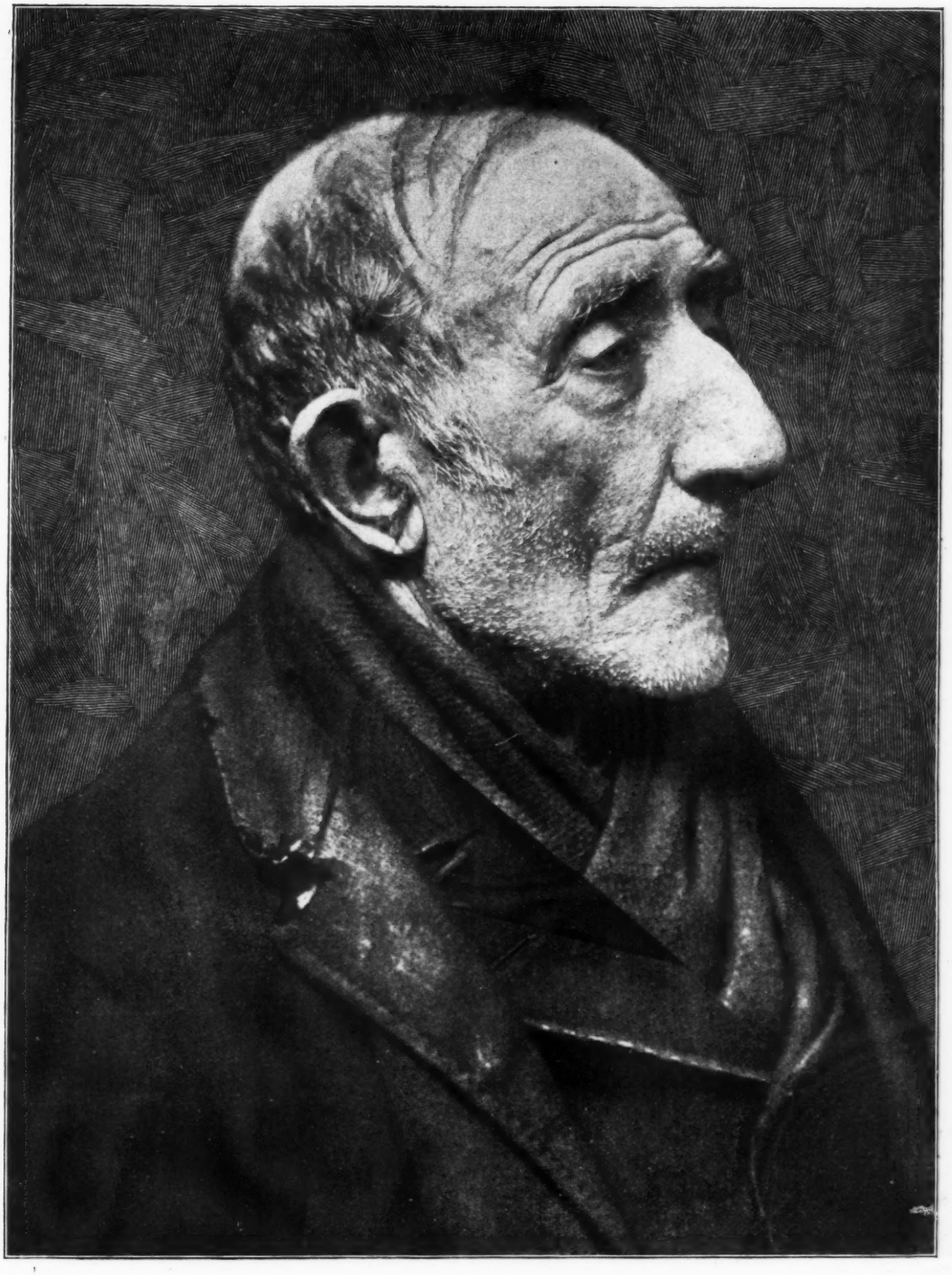
I hereby notify you that the revision of the awards granted by the International Class and Group Juries of the Paris Exposition of 1900, is completed by the Superior Jury, and the decisions now reached are final and offlcial.

The exhibit of the Standard Manufacturing Company in Class 111, group 16, received **A Gold Medal.**

Yours very respectfully,

[Signed] HOWARD L. ROGERS,
Director of Education and Social Economy

Approved:
FERDINAND W. PECK,
Commissioner-General.

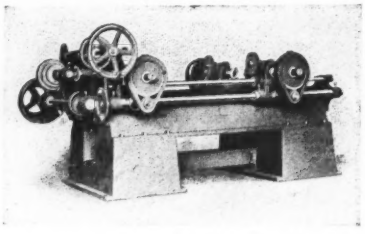


THE OLD ITALIAN.

This plate is a specimen of half-tone engraving by the Standard Engraving Co., 630 Chestnut St., Philadelphia.

This 4 Spindle Heater Drill

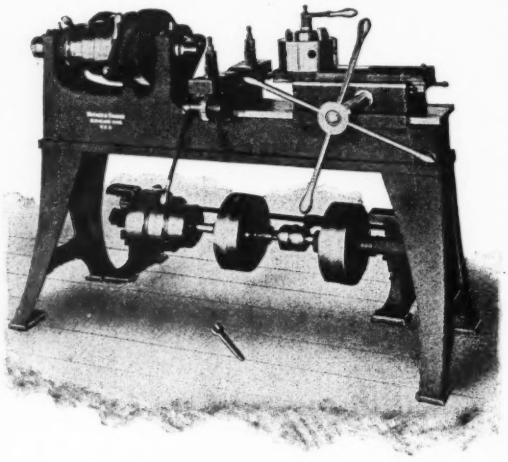
is designed for boring, facing and tapping radiator, heater and boiler sections.
Spindles have both hand and power feed, quick advance



and return and automatic stop, and will bore and face four 5 inch holes at once.
We build also a six spindle machine for making three-part sections. See new catalog for description of 4 spindle radiator drill.

The Bickford Drill & Tool Co.
CINCINNATI, OHIO, U. S. A.

A COMPLETE LINE OF
Brass Working Machinery



16-INCH TURRET LATHE
with Geared-Friction Head
SEND FOR CATALOGUE

WARNER & SWASEY
CLEVELAND, OHIO

STANDS ALL TESTS

IN ORDER TO OBTAIN THE BEST RESULTS
IN RADIATION IT IS NECESSARY TO USE

The Argon Automatic Air Valve

It is the only one on the market equally efficient on both Steam and Hot Water Radiators.

TESTED FOR AIR
TESTED FOR GAS
TESTED FOR STEAM
TESTED FOR WATER
TESTED FOR SERVICE
TESTED FOR PERFECTION
AND NOT FOUND WANTING
EVERY ORDER BRINGS
ITS DUPLICATE

Steam Heaters, Contractors and Fitters are not acquainted with the best Valve on the market, unless they have tried the ARGON.

The decision of experts, evinced not only in opinion, but as the result of experience, is that the

ARGON VALVES DO THE WORK
ARGON VALVES ARE RELIABLE

Need No Adjustment
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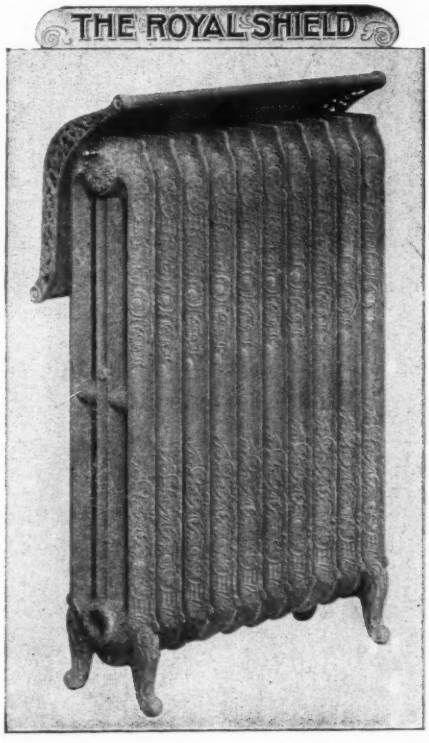
The Argon Manufacturing Company
DENVER, COLORADO.

Place Orders Now for

The Royal Shield



The best on the market for the following reasons:

- Stronger in construction
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- Lower in price than any other made
- Can be attached to any radiator

We guarantee these shields to be on a par with the high standard we have always maintained.

Write for Circular and Price List.

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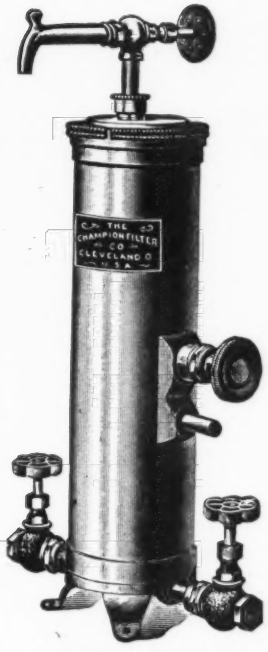

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ARE

Germ Proof and Give Perfect Satisfaction

MADE IN

FIVE STYLES AND FOURTEEN SIZES.

Secure a profitable Agency.

Catalogue and Prices upon application.

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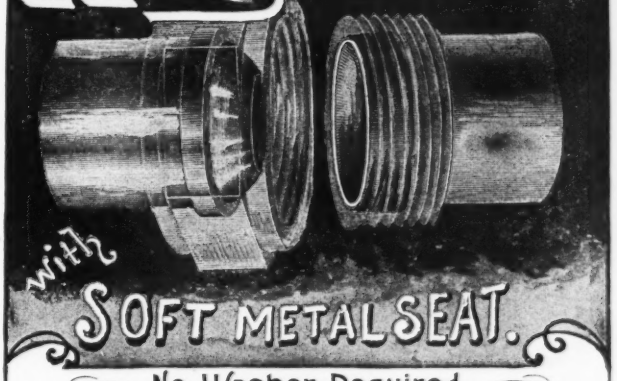

with SOFT METAL SEAT.

No Washer Required.

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220 Broadway, NEW YORK. 19th St. & Penn. Ave. PHILADELPHIA.

FOR SALE BY DEALERS EVERYWHERE.

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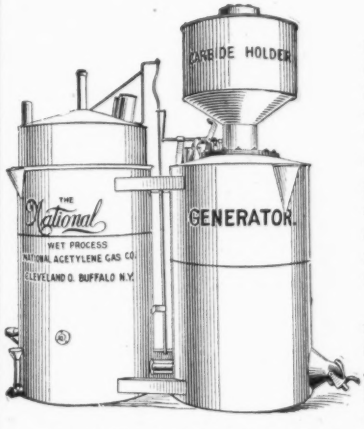

The only machine on the market which can be loaded with enough carbide to run 30 days or more without recharging. The only machine which does not produce after-generation when lights are turned off. The only machine which does not allow the gas to escape while recharging.

The carbide is fed into the water in a granulated form, thereby insuring cool, pure gas at all times. By our process of purification we are enabled to use Acetylene gas for cooking and running gas engines. The new National is fully approved by all the Boards of Fire Underwriters throughout the United States. **Local and General Agents Wanted**

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We make a specialty of furnishing paper for publications in any quantity desired, and solicit enquiries from buyers wishing standard goods at the lowest prices consistent with quality.

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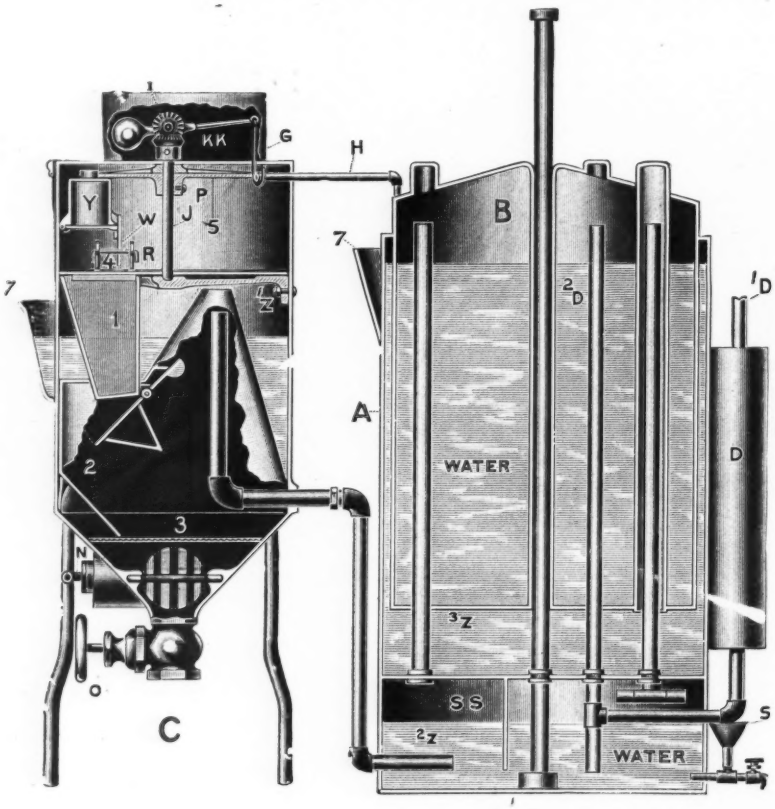
Approved by National Board of Fire Underwriters

THE MOST PERFECT ACETYLENE GENERATOR EVER PLACED ON THE MARKET.



AUTOMATIC SIMPLE SAFE DURABLE ECONOMICAL

The Drake Generator is not an experiment nor does it belong to the "tin can" class of generators of which there are so many on the market. It is made on the only principle sanctioned by Acetylene Authorities and is made to last. The gas is generated under water and after passing through a second body of water and our special purifier is delivered to the burner in the highest state of purity, this means economy. If interested send for Catalogue "H" and price list.

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Largest Makers of Heaters and Lighting Apparatus in the World

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237 Water St.	47 Union St.	48 Dearborn St.

PARIS GOLD MEDAL 1900

Our New Heater

The Acme No. 15

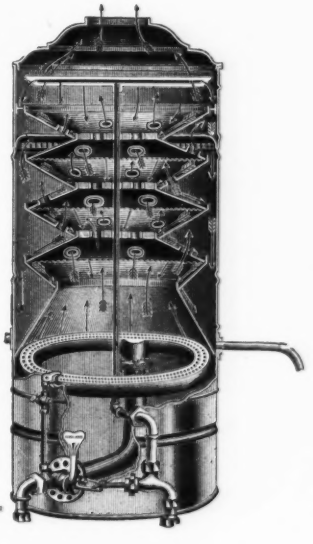
Will please your trade. It heats more water with a smaller Gas Consumption than any other Heater on the market.

It is 28 inches high and 12 inches in diameter

List price, nickel plated,

$20

IT HAS A LARGER HEATING SURFACE CONSIDERING ITS SIZE, THAN ANY OTHER HEATER ON THE MARKET.



There are other new features that will interest you. For information about them and discounts, address

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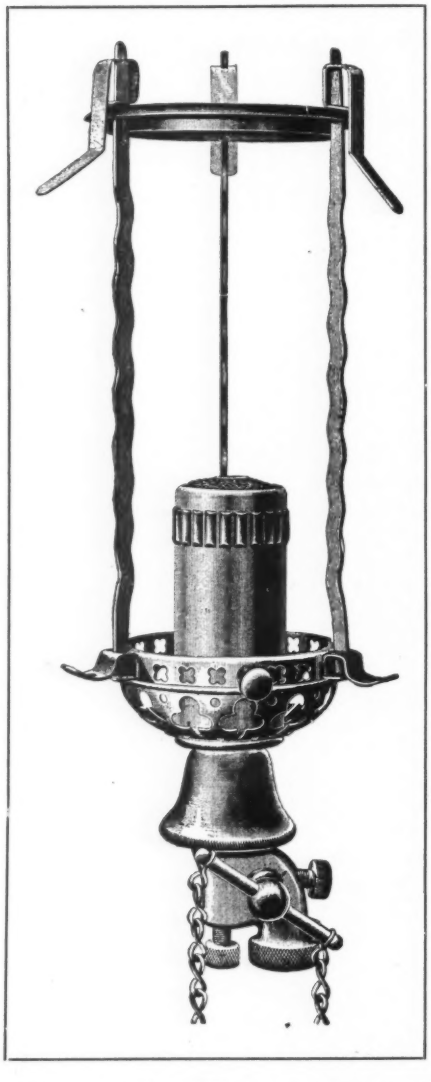
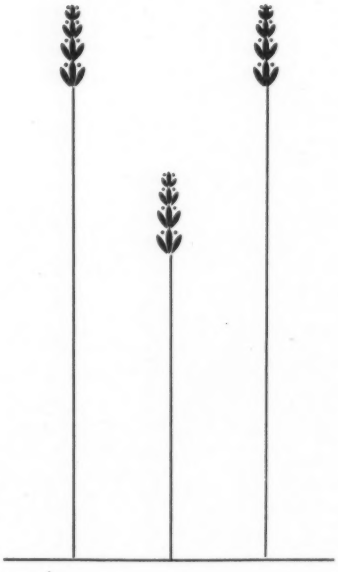


Incandescent Gas Burner



Entirely new and novel. Its special features: A practical gas adjustment—no reaming; A by-pass as it should be—non-clogging; A night light as you want it—better than the old-time taper. :: :: :: :: :: ::

For Natural, Artificial or Gasoline Gas

The S. Bernstein Company

82-86 WEST BROADWAY, NEW YORK

Another Eagle

Ready to Fly

Style No.5

PRICE

$25

FOR THE MONEY IT HAS NO EQUAL

Fitted with the INTER-LOCKING VALVES and SAFETY PILOT which are already making the Eagle No. 3 a winner.

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Humphrey

Crescent Instantaneous Water Heaters

of course

No house complete without this most perfect device

Price, Nickel Plated,

No. 6 Heater, $25.00

Height 30 inches
Diameter 12 inches
Net weight 45 pounds
Shipping weight 75 pounds

No. 8 Heater, $22.00

Height 30 inches
Diameter 10½ inches
Net weight 35 pounds
Shipping weight 60 lbs.

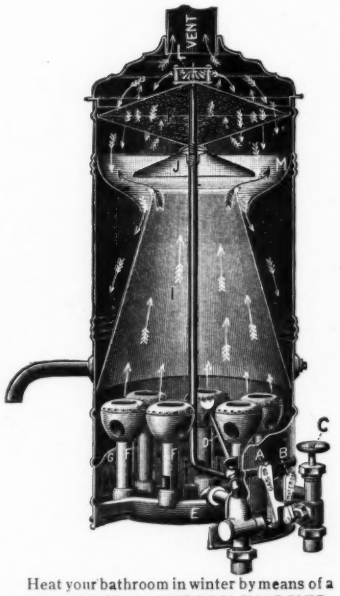
Guaranteed to heat 50% more water in a given time than any heaters of their class in the world.

No. 6

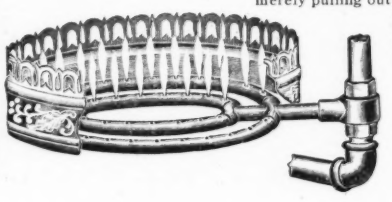
Because

They are absolutely unequalled in every respect, and guaranteed to be all that we represent.

Our No. 6 and 8 Heaters are the most powerful heaters in the world. Cost less than any satisfactory Heaters in the market, and cannot be approached in heating capacity, or in any way.



one cent buys a bath



Heat your bathroom in winter by means of a **CRESCENT BATHROOM WARMER.** This simple device is connected without extra pipe beneath the heater shelf, and is out of the way when not in use. By merely pulling out into the room, the gas supply is opened and burner can be lighted. An inexpensive luxury and neccessity.

Price Nickel Plated $3.00

Write for our handsomely illustrated booklet and catalogue **"How the Millions Have Bathed,"** dedicated to the Great Washed, and sent free upon application to

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LOVING COMPANIONS.

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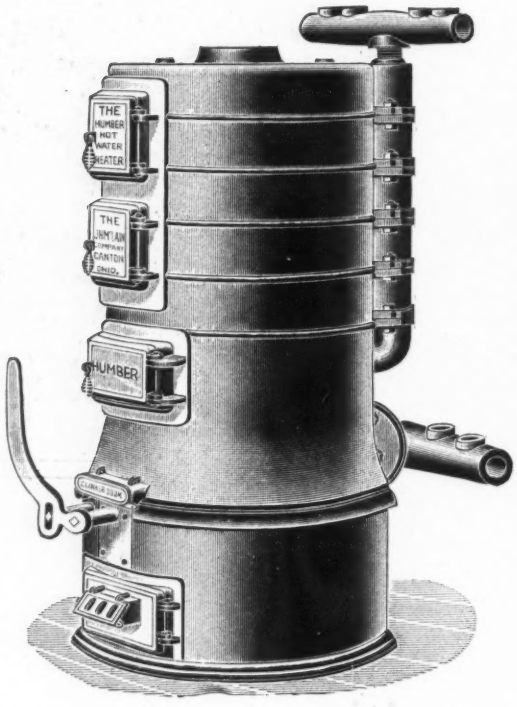
Hot Water and Steam Boilers



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HOT WATER HEATERS AND STEAM GENERATORS

Best in Use ::::: All Steel ::::: No Coils "Flues" No Cast Iron Sections ::::: Send for Catalogue

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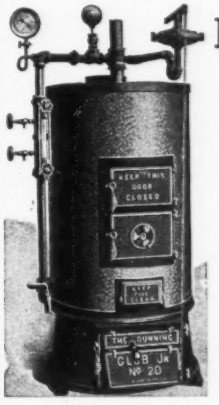

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A NEW TYPE FOR SMALL HOUSES.

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No. 15	175 ft.	275 ft.
No. 20	200 ft.	325 ft.
No. 30	250 ft.	425 ft.
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Never leak :: Always reliable

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PERFECTLY TIGHT UNDER ALL PRESSURES OF STEAM, OIL OR GAS

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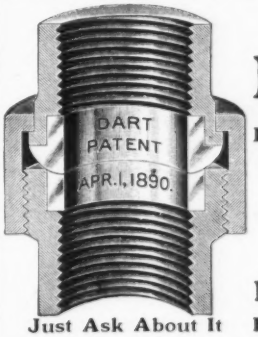

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PRES., CLARKE MERCHANT
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COMPLETE INSTALLATIONS MADE

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THE BEST

The Company has a *complete equipment* for both the WET AND DRY SYSTEMS of Automatic Fire Extinguishers.

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It is the *simplest, most reliable, most certain and most effective*. From *20 to 70 per cent. of cost of insurance saved* by putting "International" Sprinklers in your *foundry, factory or store*. Write for full particulars.

One End Water Connection.

Saves extension of pipe to further end of hot water radiators. Makes better, cheaper and neater work. Get new catalog of this new thing.

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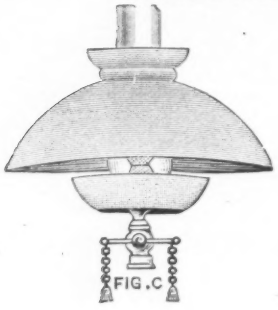
The Niagara Gas Burner

GIVES A FLOOD OF LIGHT



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Extra Brilliant **Bronze Powders**

IN GOLD, ALUMINUM AND ALL COLORS.
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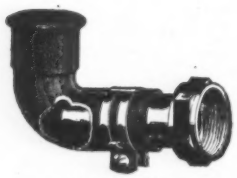

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Rubber Adjustable Elbow.

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Acetylene Gas Burner

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BROOMELL'S VAPOR SYSTEM or STEAM HEATING.

Adapted to buildings of any kind or size. Has all advantages of hot water heating without any objectionable features. Absolutely noiseless. No pressure. No air valves. No pumps or machinery. Superior to any other system of heating and costs less. Installed by all steamfitters. : : : : : : SEND FOR CATALOGUE.

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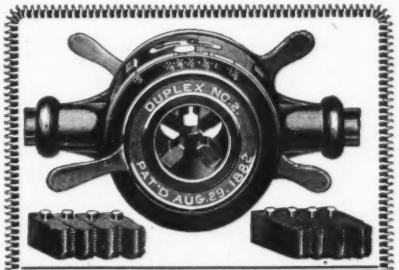

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Made of Malleable Iron All ways the best. Carried in stock and for sale by all Supply Houses.

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HAVE YOU SEEN
The **Furman**
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Sectional—Self Contained—Surface Burning—19 sizes—Capacities 350 to 4000 sq. ft.—Any size can readily be enlarged—Let us send you Free our new Catalogue and Fitter's Hand Book of valuable information for Practical Fitters. **Write for them to-day.**

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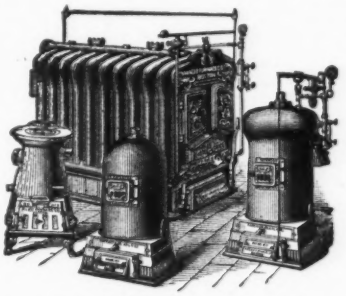

MAGEE STEAM AND HOT WATER **HEATERS**

GOLD MEDAL PARIS EXPOSITION HIGHEST AWARD

THE MOST COMPLETE LINE UNDER ONE NAME MADE IN THE UNITED STATES

OUR CAPACITIES RANGE IN
Square feet of Water Radiation 100 to 6,000
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DIXON'S GRAPHITE COMPOUND

Is infinitely better than red or white lead for making steam, gas or water pipe joints. Joints will be tighter, and can be broken months or years after without damage to pipes or tools. IT WILL PAY EVERY PIPEFITTER TO SEND FOR SAMPLE AND CIRCULAR.

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The heating trade can please their customers and make money handling the

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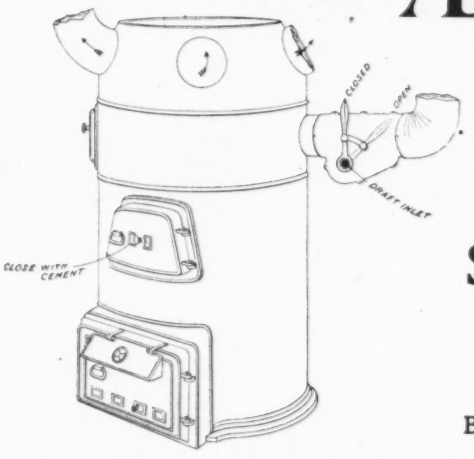

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Saves
TIME
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AND
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Besides Making Additional Heat

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The Challenge
AUTOMATIC WATER LIFT

FOR TANK OR DIRECT PRESSURE.

Balanced valve. Always works.
Cannot stick. Fully guaranteed.
M hydrants, plumbers' brass work.
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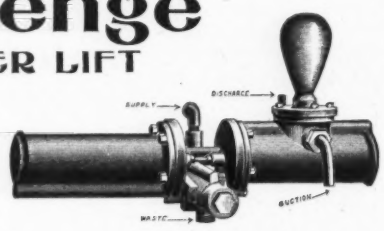

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Don't be a Hidebound Hawkins

There is some where in the United States (we don't like to say just where) a manufacturer of brass articles who was investigating our **Forming Lathes**; we looked over his work and told him the number of pieces per day our lathe would make, and then he wouldn't buy a lathe because he said **HE COULDN'T SELL MORE THAN HALF AS MANY GOODS AS THE LATHE WOULD MAKE.** We have nicknamed this man "Hidebound Hawkins." ::: ::: ::: ::: :::

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Always ready for instant use.

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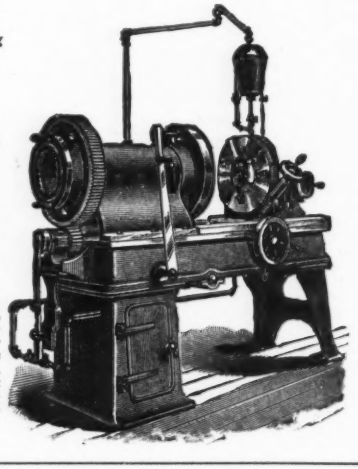

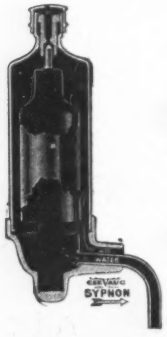

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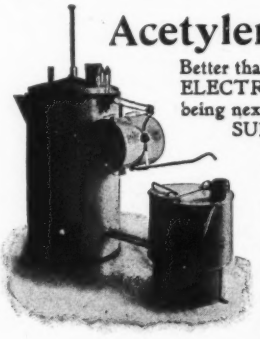

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Alexander Furnace & Mfg. Co., Lansing, Mich.

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The CLINE is made only by the
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WRITE THEM AT ONCE FOR FULL INFORMATION. LANSING, MICH.

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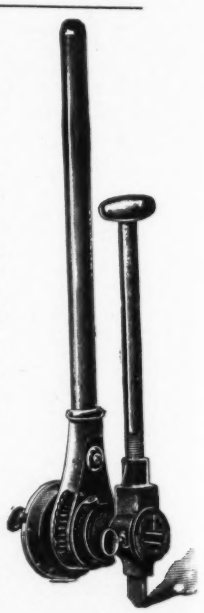

Is an indispensable tool for conveniently threading iron pipe in ditches, under floors, in corners, overhead, etc. With this tool threads can be cut without removing whole lengths of pipe. This tool is provided with a strong vise which securely grips the pipe, and by means of the leading thread the die is forced on pipe and the thread is cut. It is made of malleable iron and steel, and, while light in weight, making it convenient to carry, is very strong and rigid. The advantages of this tool make it absolutely indispensable to Plumbers, Steam and Gas Pipe Fitters, Gas and Water Companies, Machinists, etc. It takes standard size dies, which are extra if furnished.

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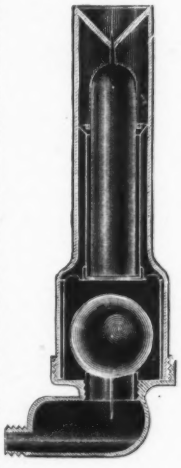

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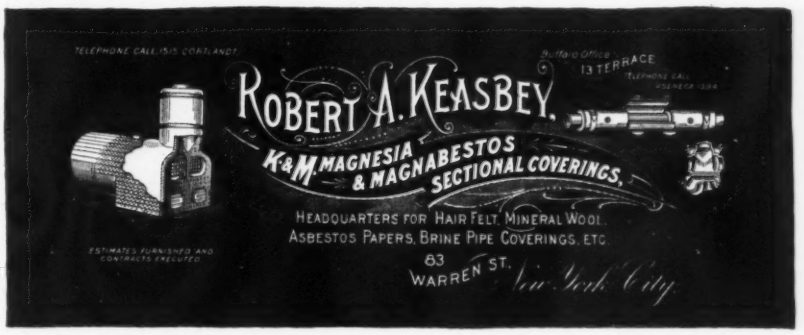
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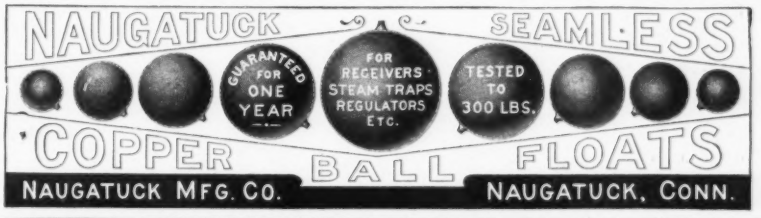

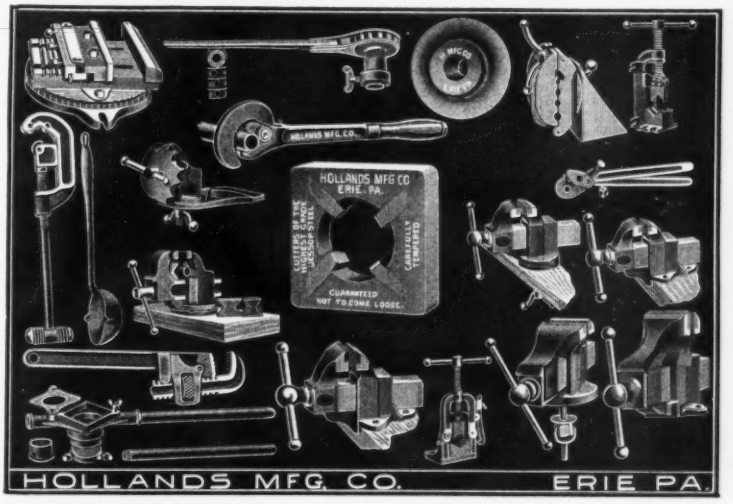

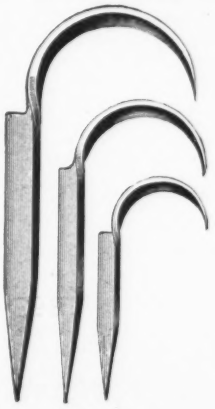

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Complete stock of every size and kind. The quality the best only. No imperfect goods : : : B.B. ornamental strap is the finest made : : :

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A Paul System Heating Plant

Costs less to operate than any other type of heating plant. No disagreeable odors from air valves. Every square inch of heating surface rendered effective. Steam held in radiator until condensed. Water returned to boiler at high temperatures.

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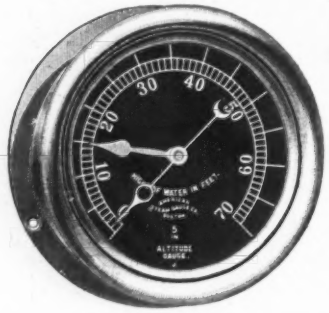

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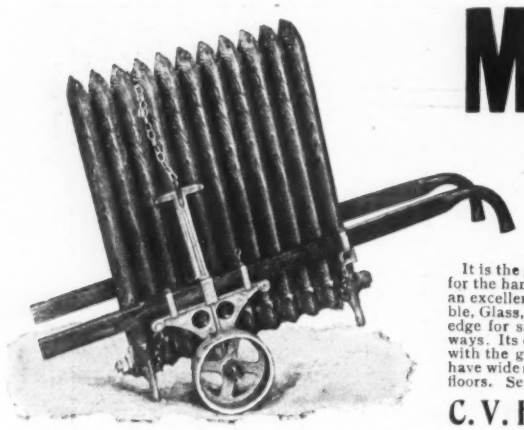

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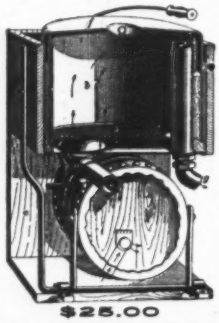
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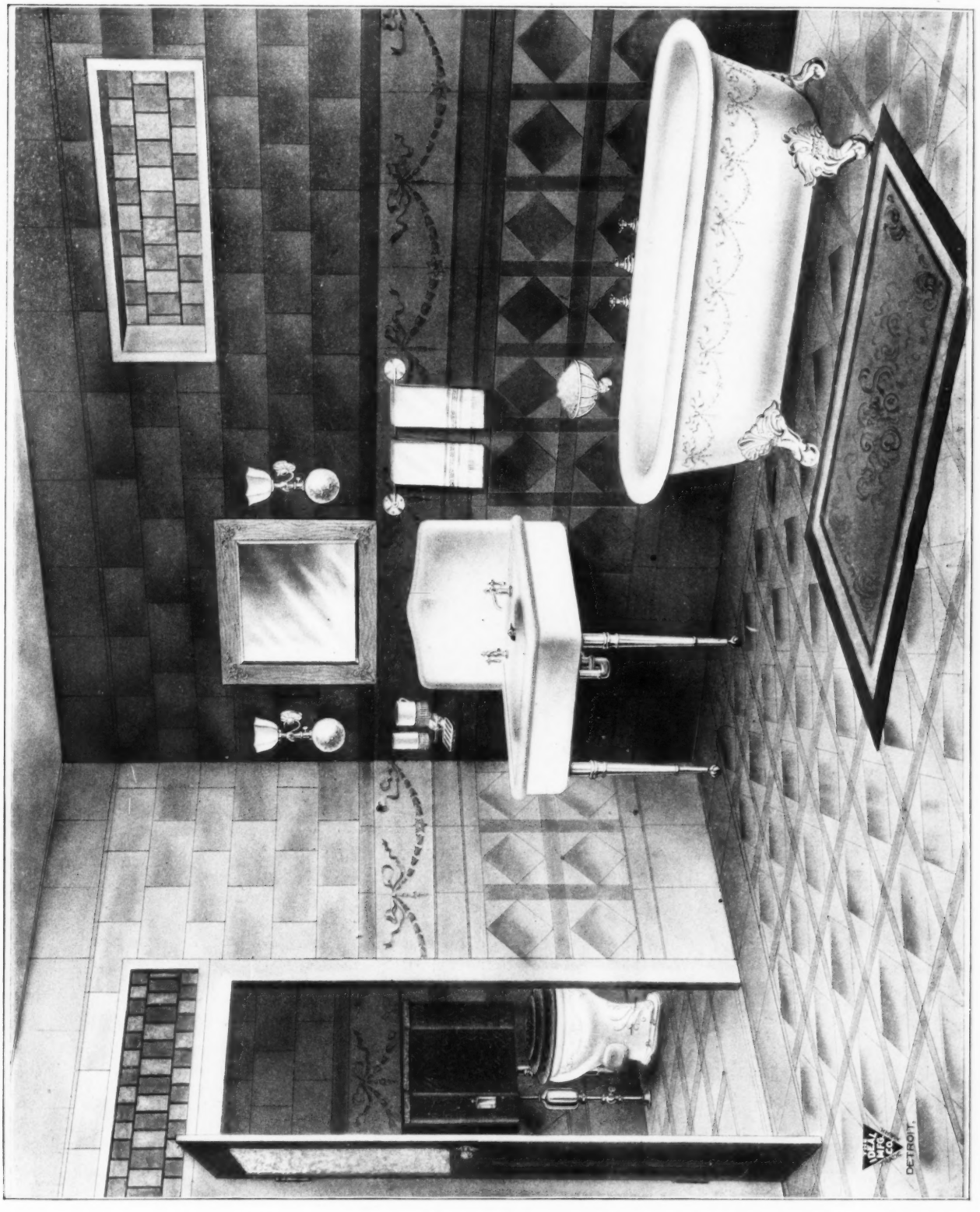

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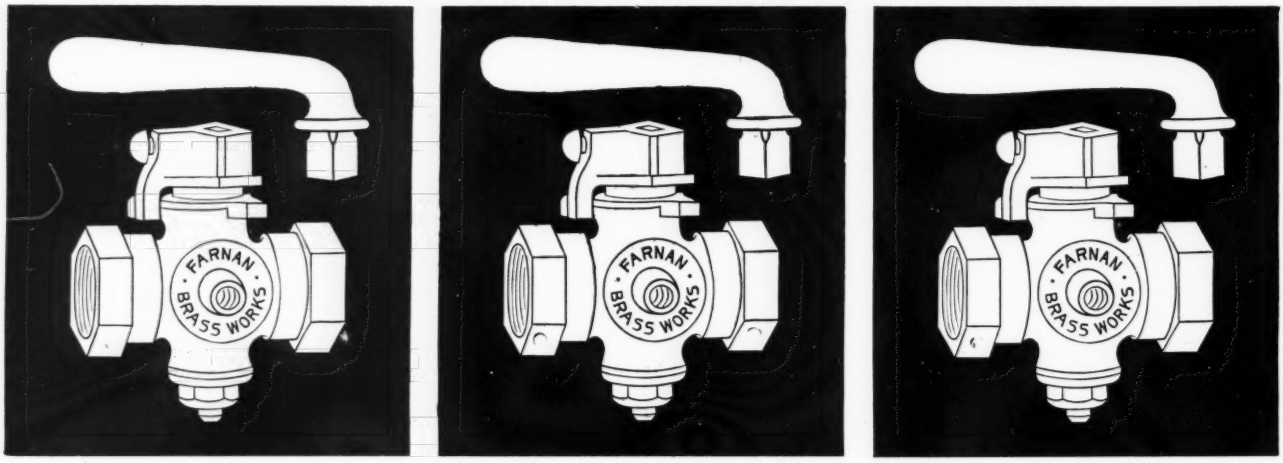

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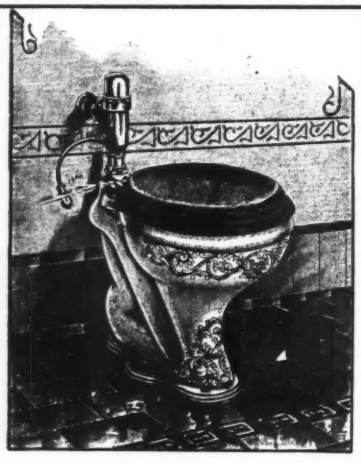

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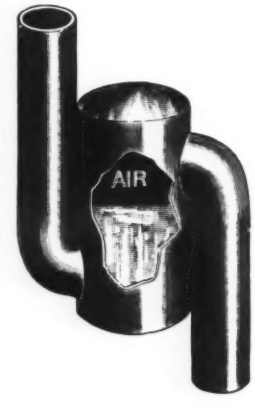

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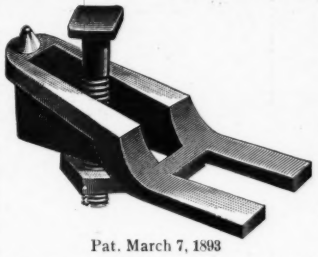

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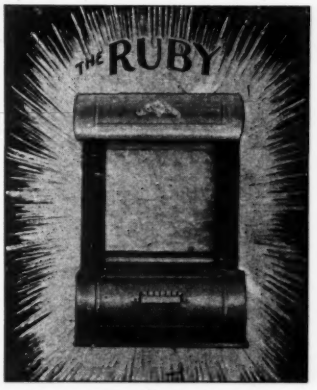

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It is not as fancy as some others, but is guaranteed as good in every way, and you can buy it at a price that will secure the business. Only one room in a few houses requires a fancy heater and all the remainder want a plain durable stove. **Write for prices and Cat.**

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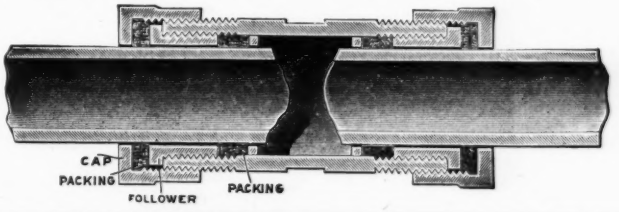

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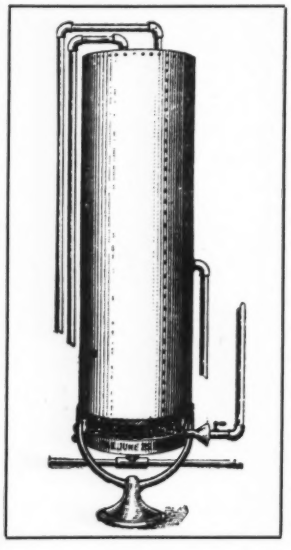

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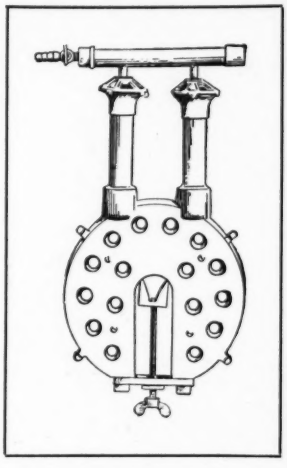

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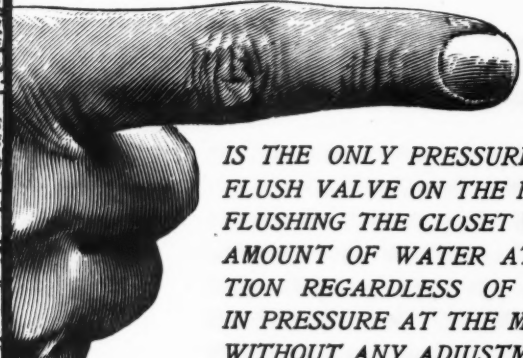

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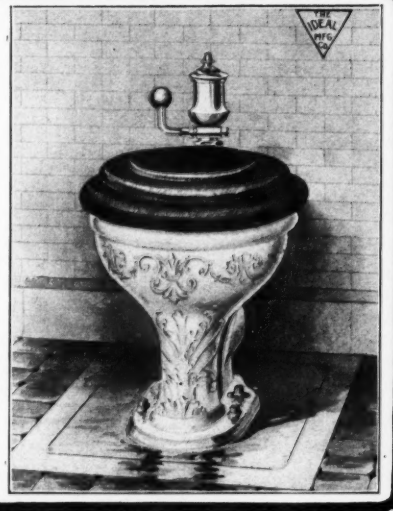

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Whole No. 134 *DECEMBER TWENTIETH, NINETEEN HUNDRED* *Vol. 20, No. 3*

The Disposition of City Waste.

By E. R. Pritchard, Secretary Chicago Health Department.

In a general way the term garbage may be taken as including any and all forms of household waste. The sanitarian, however, does not class ashes and cinders, old metal, such as tin cans, etc., nor waste paper as garbage. True, all of these articles go to make up what may be correctly termed kitchen and household refuse, and all constitute material the proper collection and disposition of which becomes an important sanitary and economic problem in any large city. But, from both the sanitary and economic standpoint, it becomes necessary to consider garbage under not less than three separate products:

1. Ashes and cinders. 2. Waste paper, tin cans and old bottles, sawdust and general combustible rubbish. 3. Garbage proper, including all animal and vegetable matter and all kitchen and table refuse usually classed under this head.

Tin cans and bottles might well be considered as a separate division, but as they are easily picked out, and like waste paper have a market value, in order to make the fewest possible divisions, they are put in one classification.

* * *

The first step in the solution of the garbage problem, as a whole, is the process of collection, which should be such as to facilitate to the greatest possible extent the final disposition—using the term garbage to cover all household waste and refuse—in a proper sanitary way. In connection with its sanitary disposition, but not demanding our first consideration, comes economic disposition.

It has been proven by both experience and observation that it is more economical to separate garbage from all other waste material as it is collected than it is to collect it in mixed form, and that it also aids in the disposition of it in a sanitary way. This is true, no matter what the process of disposition may be, it being understood, however, that in our study of the garbage problem the out-of-date, not to say barbarous, dump system is not nor could not be taken into consideration as having anything at all to do with either the sanitary or economic disposition of a city's waste and refuse matter.

Returning then to the initial move to be made, which is the prompt, regular and proper collection of garbage, it requires but a glance to discover an important rule to be observed. This rule, which in itself is a basic principle to be followed in the successful working out of the garbage problem, may be stated thus:

The collection of garbage must be a means to the end sought, which is sanitary and economic disposition.

* * *

We start at the source of production, but all the time we must have our attention directed to the final disposition. Garbage is not collected, or should not be, solely to get it removed—that is, out of the sight and presence of the homes in which it is produced. If that were all of the problem, then a clayhole in the outskirts of the city would cut as important a figure in the matter as would the latest improved incinerating or reduction plant.

It should also be kept in mind that the people have a work to do in helping to carry out a public service of this kind. They produce the garbage and they can and should aid the municipal authorities in getting rid of matter the presence of which is a constant menace to the health of the entire community. The first duty devolving upon the garbage-producing citizen is to make as little of it as possible. Next he should aid the city, which assumes the work of removing and disposing of this waste and refuse material, by putting it into as convenient form as possible for collection and removal.

Of course, all this may be provided for by municipal regulations, but these are likely to prove largely inoperative unless met with a spirit of co-operation on the part of the people. In this connection, too, it may be noted that it is not alone in the matter of garbage that the good citizen may aid the municipal authorities in enforcing regulations the proper observance of which adds to the comfort and happiness of all.

* * *

Assuming, however, that the citizens, appreciating the value of sanitary surroundings, are both ready and willing to co-operate with the municipal officials in the certainly important work of making and maintaining a cleaner and more habitable city, what should be the regulations for the collection of garbage and its preparation for those to whom the work of collection is given? Let us note them in numerical order:

1. Garbage, which includes all animal and vegetable matter and kitchen waste, must be separated from all other waste and refuse matter. To do this the householder must provide separate receptacles for the family waste—one for garbage, one for ashes and cinders and one for general rubbish.

2. Garbage may then be collected either in wagons which hold nothing else or in wagons having boxes provided with partitions by which it can be kept separate from the general rubbish.

3. Ashes and cinders should be collected in wagons used for this purpose alone, as they are easily disposed of and have a market value which should be sufficient to pay for the cost of collection and removal.

Like garbage, general rubbish, being made up of paper, straw, rags, bottles, old iron and metal of all kinds, including tin cans, pieces of carpet, old shoes, mattresses, castaway stockings, barrels, brushes, twine and many other articles, too numerous to mention, has a value. All of the articles named when rescued from the common pile and properly assorted have a fixed market value and are as readily converted into cash as are government bonds or No. 2 winter wheat.

* * *

In New York city matter of this character is picked over at the dumps by a small army of people trained in the business, who are employed by a contractor who pays the city $50,000 a year for the privilege. It is said, too, and on authority not to be doubted, that this shrewd Italian realizes a profit of from 50 to 75 per cent on his investment.

After the pickers are through with their work the remaining material, or most of it, is loaded upon scows and taken out to sea, where it is dumped. A small portion only of the general rubbish of New York city is at present disposed of by incineration, but even here it is first subjected to the picking process and all material of any value taken out before being committed to the flames.

General rubbish, being made up largely of combustible material, can be more easily and cheaply disposed of, after the picking process, than can pure garbage. The latter costs money to burn and should not be disposed of in this way for the reason that it is too valuable. In what its value consists and how it is made to yield a revenue is in itself an interesting subject, and will be taken up in our next study of the garbage problem.

II.

In the present paper we are to discuss the problem involving the sanitary and economic disposition of garbage, which, as already explained, includes all animal and vegetable matter and kitchen waste.

It will be readily seen that this class of refuse, containing a large percentage of moisture, together with decaying animal and vegetable refuse, should not be carted away to be deposited in some vacant lot or used for filling up an abandoned clay-hole. Matter of this kind decomposes rapidly, and when deposited in large quantities emits an indescribable, offensive odor, which permeates the air for blocks in the vicinity, and is blown by the wind for miles.

To dispose of matter of this kind by incineration would be, beyond all question, a sanitary disposition, for of all agents which may be used for the destruction of unsanitary material of any kind—including infected clothing, rags, bedding, and even buildings of a tumble-down character—fire is the most effectual. It is not, however, always the most advisable means to use, for the reason that other methods less expensive and equally safe may be employed. To follow this further, however, would be to enter upon another field of sanitary effort, which would have to do with the handling of contagious diseases and the prevention of the spread of contagion.

* * *

The principal objection to the disposition of garbage by burning—or, more properly putting it, by incineration—in a plant especially constructed for that purpose, is that it is too valuable a product to be thrown away in this manner.

The present is an age of economy in the utilization of what were formerly regarded as waste or refuse products. Time was when a certain contractor who had the contract for removing the dead animals from the streets of the city of Chicago was paid $37,500 a year for performing that service. At the same time, too, he was engaged in skimming that odoriferous branch of the Chicago river known as "Bubbly creek," and it is said upon good authority that while he made big money out of his city contract he grew rich out of "Bubbly creek."

To-day the contractor who removes the dead animals from the city's streets pays the city $5 a year for the privilege, and has a contract made for five years, dating from some time in 1896, under Mayor Swift's administration. The present contractor, it may be stated, although he is doing the work for nothing, is by no means losing money, and thecity is, of course, $37,500 ahead each year during the life of the contract.

At the same time, too, no one is skimming "Bubbly creek," for the reason that the big packing houses at the stockyards have years ago taken steps to prevent the escape of the grease into the sewers and thence into the dead end of the river. The saving thus effected amounts to hundreds of thousands of dollars annually, and only illustrates the oft-repeated saying that the squeal of the hog is the only thing which is permitted to go to waste at the yards.

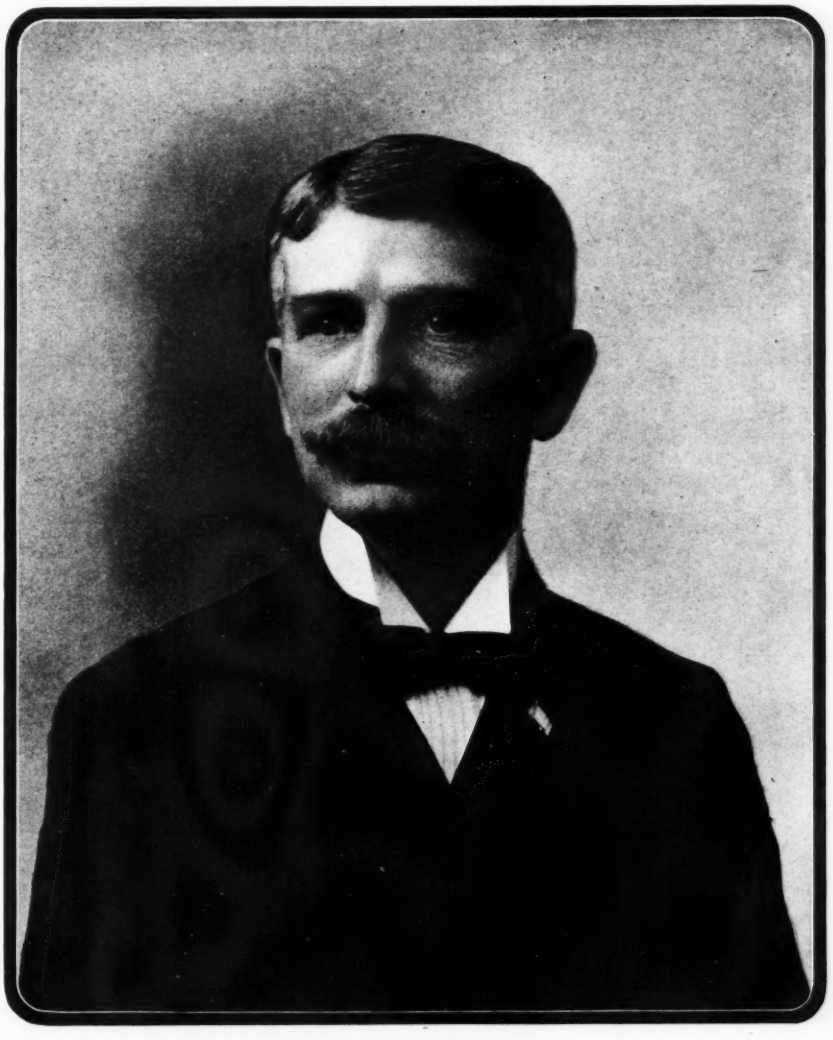
So a city's garbage has in it too much valuable material to be thrown away, either by permitting it to fester and rot on "the dumps" or by burning it, at a cost of from 60 to 80 cents a ton, exclusive of the cost of collection and delivery at the place of incineration.

* * *

Pure garbage—by which is meant garbage separate from all other waste material—contains two sources of revenue. One is grease, the other is fertilizing material.

Ordinary city garbage, properly treated by the reduction process, will yield on an average 3 per cent grease in weight. This product is obtained by what is known as the tanking process, and is used for soap stock. It is worth at the present time from 2¾ cents to 3 cents per pound, or at the last named figure $60 a ton. On a basis of a yield of 3 per cent of grease at 3 cents a pound, the total yield

A PROMINENT BUYER.



E. A. MORRIS.

Treasurer and Secretary of the Detroit Lead Pipe and Sheet Lead Works, Detroit, Mich.
New President of the Central Supply Association.

from a single ton would be worth $1.80. This may be taken as a maximum figure, as both the yield of grease and the market price of the same are subject to change.

The amount of fertilizer base, as shown by several different reduction processes, will show an average yield of about 15 per cent. The value of this produce, which it known as "tankage" is not so definitely known, but in a general way it may be said to range from 60 cents to $1 per ton of garbage.

Here we have as sources of revenues an average return per ton as follows:

Grease	$1.80
Tankage	.60
Total	$2.40

These figures, it may be stated, show that so far as garbage is concerned, if disposed of by the reduction process, it may be made to pay the total cost of collection and disposition and a profit besides.

* * *

From the above figures it will be seen that if the reduction process can be conducted in a sanitary manner and without offensive odors, no city can afford to adopt the process of incineration, which is one of all outlay with no returns. My own idea is that the ideal plant for the disposition of city garbage is yet to be built, and that when it is built it will be a plant combining the reduction and incinerating processes.

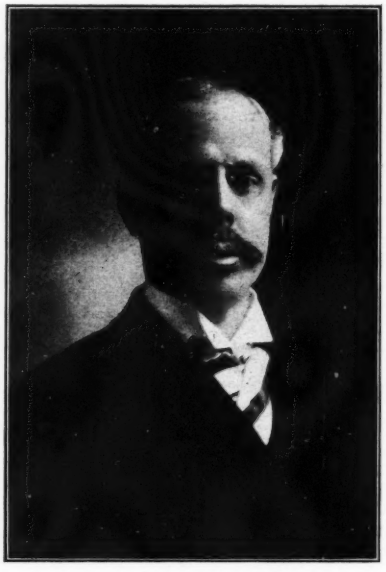
As a matter of fact, this idea is now being partially carried out in the private reduction plant operated by the C. Turner Company at Twenty-sixth and Archer avenue, where a large portion of the rubbish mixed with the garbage is sorted out and is used for fuel, reducing the coal bills by almost one-half. It should not be forgotten, however, that even if a combination plant is used, the method of collection, as to separating the garbage from all other waste matter, should still be followed. And, of course, where both garbage and rubbish are delivered at the same plant for disposition the latter should be subjected to the picking process in order to get from it any and all material having a market value.

Taking city waste as a whole, exclusive of ashes and cinders, the following items having a money and therefore a market value may be noted: They are grease, fertilizing base, bones, old metal, including tin cans; bottles and waste paper, old rubber, twine and rags of all kinds. These, properly assorted, form so many distinct sources of revenue and go to make up the total value per ton of garbage, a value so easily defined and turned to account that any system of garbage disposition in which these sources of revenue are not carefully considered and provided for can by no means be regarded as being up to the standard of economy and thrift which to-day obtains in the business world.

III.

Having discussed the collection and disposition of garbage from the standpoints of sanitation and economy, as forming an important problem in handling a city's waste, we come next to a different class of matter, the proper handling and disposition of which also has much to do with a city's cleanly and sanitary appearance.

In a great city like Chicago vast quantities of ashes and cinders are produced each day. Particularly is this true during the winter months, when every family is contributing its share toward the general supply. During the summer months the production of this class of refuse is confined mainly to the manufacturing districts and in the downtown portion of the city, where steam plants are in constant operation.



A. M. COLLINS, OF CHICAGO.
Buyer for E. W. Blatchford & Company.

On account of the fact that almost the entire unimproved portion of the city lies below the established grade, Chicago has abundant use for this class of refuse matter. Indeed, if this were not true, it could still be used in filling the numerous unsightly and dangerous clay holes throughout the city instead of filling them with garbage, as is now done.

It is within the power of the commissioner of health to compel the owners of all such places, which on account of their being partially filled with stagnant water may become a menace to public health and life, to fill them and to use only sanitary material for the purpose. At this time there are not less than half a dozen large garbage dumps within the city limits, the foul odors of which, if they do not smell to heaven, at least pollute the atmosphere for many blocks in the vicinities where they are located. Under the present system the city is paid for doing work of this kind; the money thus received is added to the appropriation of the street and alley cleaning bureau.

* * *

There is no defense at all to be made for the dump system of garbage disposition. There is no question either that it should be discontinued, and that all clay holes should be filled with ashes, cinders, street sweeping and general rubbish other than animal or vegetable matter. Were this done, the effect would be at once greatly to in-

crease the value of ashes and cinders and street sweepings, and this in turn would enable the city to derive revenue enough from the sale of material of this kind to pay for the cost of collection and possibly leave a margin besides.

As you go about the city you will notice that many of the large manufacturing plants have signs posted at their gates which read:

CINDERS GIVEN AWAY.

During recent years and owing to the large amount of concrete and cement construction work, such as sidewalks, courts and driveway paving, the demand for cinders is so great that not a few teamsters find profitable employment in hauling cinders from places where people are glad to get rid of them and selling them at a good price to the paving contractors. The demand for cinders for this class of work is likely to continue, so that it will, no doubt, be some time yet before they can be had in any great quantities for general filling purposes.

A final word now as to dumps: With the city's growth and development and the advance of public opinion on matters of health and sanitation, the time is near at hand when the commissioner of health will be warranted in stopping them altogether. Ashes and cinders should be collected in wagons used only for that purpose, and in the event that they cannot be at once disposed of for filling, should be stored under sheds at some designated place in each ward until such time as they may be utilized.

* * *

In closing this paper I feel that it is important again to call attention to what I deem the basic principles underlying the whole problem of the disposition of a city's waste. These are:

1. The collection must be made in such manner as best to facilitate both the sanitary and economic disposition. This demands that household refuse be separated at the point of production.

2. Such separation properly done simplifies all subsequent handling, makes it possible to treat the different classifications to the best advantage and insures a revenue which should practically cover the cost of collection and disposition.

I venture the prediction that in time the city of Chicago will reach this certainly practical solution of the garbage problem. When it does there will be no more unsightly alleys, with their vistas of overflowing garbage boxes, their contents exposed and poisoning the air with noxious odors. With the disappearance of the garbage box from our alleys would also come the abolition of the manure box, and these done away with and the alleys once cleaned I cannot conceive any one greater stride toward a cleaner Chicago.

In the work that must be done finally to bring about a consummation so devoutly to be wished, the citizens may render material aid, not only by demanding that the present barbarous system of handling garbage be dispensed with, but by giving a cordial and intelligent co-operation with the city officials in enforcing the prescribed regulations when the new order of things has been established.

Essential Features of House Drainage.

By Rudolph Hering, C. E.

THE literature on house drainage is already voluminous. Every phase of its working, and ever detail has been somewhere described, discussed and illustrated. However, if we regard the present actual condition of most of our houses, the correct principles will still have to be frequently asserted and re-asserted before such reiteration becomes a superfluous duty. Many times yet will the public attention have to be directed to this subject, in one way or another, before we shall all be able to answer affirmatively the important question, whether or not the house we occupy is entirely secure against the intrusion of unhealthy matters from our drains, through the air that we breathe or that pollutes our food and drink with its dangerous floating germs. It would be superfluous in the presence of distinguished medical men more than to allude to the dangerous qualities that may be possessed by air which has been in contact with decomposing organic matter, especially of an excrementitious nature. But it should be emphasized here that, whatever these dangers are, it is in the house, much more than in the streets, that they are most disastrous to the population. In the streets there is a chance for the foul matters to be mixed with an abundance of air, which circulates through them and passes out of the town. But in a house carefully protected against winds and drafts, and often not permitting any exchange of air, the danger of foul substances suspended in it becomes apparent, and the more to be dreaded as most persons spend perhaps twenty hours out of every twenty-four in doors. It is therefore of the greatest importance to our comfort and health to have our dwelling in a sanitary condition. Very few of our cities, however, can boast of even a fair drainage of their houses. Some have recently secured legislation looking to a systematic regulation of the plumbing, but as yet only a comparatively small number of buildings in each community have been benefited thereby.

The reason can no doubt be partly found in the circumstance that the correct principles of house drainage are not generally known, even by all the plumbers who are usually entrusted with the work, and partly in the natural disinclination to expend money for altering a drainage which has perhaps so far caused no apparent ill effects. The con-

sequence is that to-day thousands of buildings are still being provided with admirable means for conducting sewer air into their apartments.

With such results it is not surprising that some persons even decline to make use of modern plumbing appliances, and prefer old methods. The system itself receives the blame which is due only to improper execution of the work. Yet the principles governing a proper arrangement are simple and well established. All risk of perils from sewer air can be avoided if they are carefully and honestly carried out, not only in the general features of the design, but also in the minutest detail.

In the following pages I have no novel ideas of any kind to lay before you. I shall give you nothing involving the

B. FRANK HOOPER, OF NEW YORK.

President of the Colw li Lead Co., Treasurer of the National Committee of the Confederated Supply Associations.

uncertainty of new views or appliances, but only what has stood the test of time and discussion. During the few minutes at my disposal it will even be necessary to confine myself to outlines and essential features. These, however, will be sufficient to gain a clear comprehension of the question.

The cardinal requirements in the arrangement of perfect house drainage may be stated as follows: (1) A rapid and thorough removal of all liquid and suspended matter from water-closets, kitchens, sculleries, bath and bed rooms, etc., so that there is no cessation of flow, no eddy, or deposit from the moment the matter enters the pipes to the moment it leaves them. (2) The prevention of an escape into the house of any air contained in the pipes under all the varying conditions of temperature, of the use and disuse of the different fixtures, through evaporation and the forcing or drawing of the water-seal in any traps. (3) A careful selection of the fixtures and the material to be used, and faithful workmanship in the making of all joints and the proper supporting and securing of every part of the work.

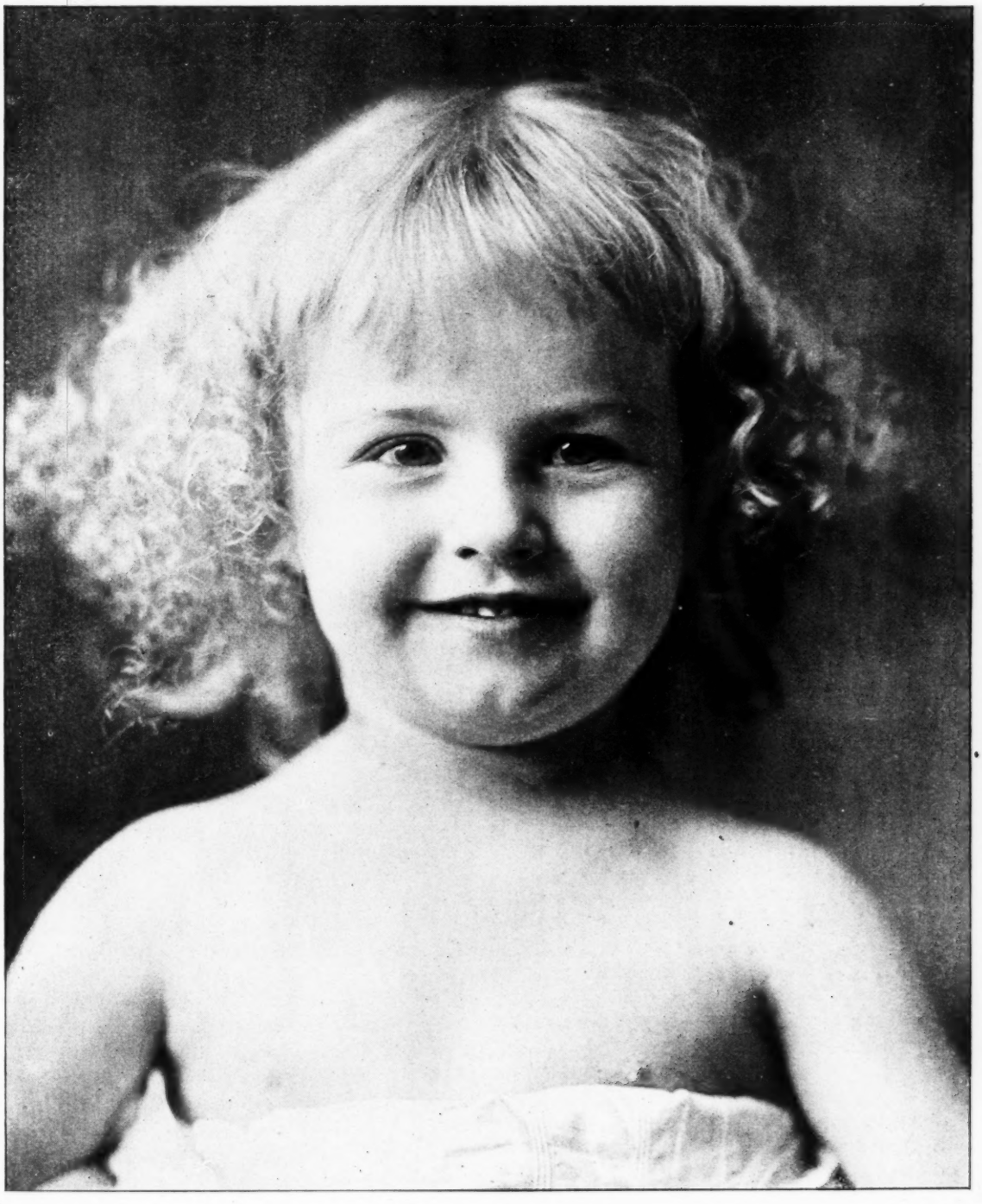
To justify these requirements, any further discussion is unnecessary. It will at once be observed that under the resulting conditions the generation of foul gases within the pipes is reduced to a minimum, and that their escape into the house is made impossible. It is true that the attainment of this end requires considerable skill, careful workmanship and good materials, but no more than is fully justified by the beneficial results obtained. It is also true that unless the above points are secured, the inhabitants of a house are much better off without any receptacle whatever for any kind of refuse and waste water inside of its walls.

Let us now examine in detail the different parts of the system. The most natural order in which to give them will be to follow the waste matter as it passes through it. We shall therefore consider, first,

THE RECEPTACLES—These consist of water-closets, urinals, sinks, wash-basins, bath and laundry tubs. I shall speak of them in this order.

a. Water-closets are the most important receptacles, as the matter they receive is not only the most offensive, but can be, also, the most dangerous when coming from a diseased body. It is necessary that their selection should be carefully considered. Unfortunately, this has only rarely been done; many poor patterns have been introduced, and but little attention is given to a proper fitting up and later to their maintenance. Foul odors about the closets are quite common, and the fear of evil consequences has sometimes even caused them to be placed in a distant part of the building and isolated as far as possible. Dr. Hamilton, of New York, even wishes them placed outside the main walls of the house. Such banishment, however, is by no means necessary. A good closet, in connection with a proper arrangement of the house pipes, can be made quite inoffensive and in no way injurious.

In general we can make the following demands upon all good closets. They should be as simple as possible, and have a minimum of moving parts which are more or less likely to get out of order. A closet with a complicated mechanism should always be condemned. The foul matters should drop into a closet as quickly as possible, in order to deodorize them, as well as to prevent them, as much as possible, from touching the surface of any part of the closet. In hopper closets this condition can only be approached with difficulty; but by making them short, to reduce the fouling surface, by placing the outlet pretty well back and by having an abundant flush of water, little trouble from the adherence of soil would be experienced. In fact, all closets should be liberally supplied with water, and in order to make the flush effectual, the whole quantity, about two



ANTICIPATING A FULL STOCKING.

This plate is a sample of half-tone engraving by the Electric City Engraving Co., Buffalo. N. Y.

gallons for each use, must be introduced suddenly. In the best closets it enters the bowl at once from around the entire upper edge, which is provided for the purpose with a so-called "flushing rim." The water rushes down the sides of the bowl with sufficient force to cleanse them, and, in the case of the "wash-out" closets, to drive out the contents of the bowl into the trap. The water used for flushing should be drawn from special tanks or cisterns, to be used for no other purpose. It is very objectionable to get it directly from the supply pipes, except where a constant and great pressure of water can be had at the closet. For it often happens from various causes that the available quantity in the pipes is so much reduced as to be quite insufficient for flushing. Sometimes the draft of water in a lower story will entirely stop its flow at the closet, and if a valve is open, even suck foul air back into the pipe and contaminate the water, which, later, may be drawn from a near spigot for drinking purposes. Hopper and "wash-out" closets, to work satisfactorily, should always be flushed from tanks. The former should, in fact, have automatic arrangements for the purpose, because the soil is not seen except in very short hoppers, and the flushing consequently is often neglected.

All closets, furthermore, should be freely ventilated in themselves, and likewise the apartments in which they are placed, because there is always more or less odor escaping when they are used. The hopper and wash-out closets can have a special pipe leading from the bottom of the bowl to above the roof, in which a small gas jet is kept constantly burning. The valve and plunger closets can have a similar arrangement, the pipe leading from the chamber below the valves. While this ventilation is not absolutely necessary, because none of the above closets will permit much foul air to accumulate, it is nevertheless worth the slight additional expense, as the apartments can thereby be kept as free from odor as though they contained no closets. I have next to consider

b. Urinals. Time will, however, permit me to say but few words concerning them. They need fully as much attention as water-closets, as an improper construction and careless use causes them to emit a strong odor. They should be given a proper shape and position, and an abundant and thorough flush of water. In hotels, railroad stations and places where they are constantly used a constant stream of water should trickle down the sides. For an occasional use, either an automatic flush or one obtained by hand should always be provided. And the water should be spread out so as to rush down over the entire surface which can be soiled by the urine. The most common pattern is a bowl fastened to the wall, and if well shaped and flushed it has no objectionable features. Another good form is a gutter running along the foot of the wall, which is provided with a face of ribbed slate, down the surface of which a constant fine stream of water is descending. The urine and water are, in both cases, led through a strainer into a pipe which should be trapped soon after leaving the fixture, as in the water-closets. The only ventilation required for urinals is a free exchange of air in the apartment in which they are placed.

c. Sinks, when used for chamber slops, should be designed similarly to urinals, and be provided with means for flushing water over the entire surface from a rim along the upper edge, as they otherwise become very foul. It is best, however, to use water-closets for this purpose and abandon slop-sinks altogether. When used for kitchen and pantry purposes this flush is not necessary, because they are usually washed out before there is much chance for decomposition. All sinks should have fixed strainers, in order to prevent large substances from entering the pipes. Their discharge pipe should be trapped as near the strainer as possible, to reduce the length likely to become foul.

d. Wash-basins require also but a few words. Being often placed in living rooms or sleeping apartments, the greatest care should be given to their proper arrangement, as the escaping drain air would be much more injurious than elsewhere. The simplest designs are here, too, the best. A simple earthenware bowl is better than Jenning's tilting basin, which readily becomes foul if not carefully and frequently cleaned. Wash-basins, like all other fixtures, should be trapped as near their outlet as possible. This requirement is here of special importance, as foul air escaping into a bed-room is doubly dangerous.

e. Concerning bath and laundry tubs, there is nothing further to say than that they should have as large an outlet as can be conveniently given them, from 1½ to 2 inches, in order to use the large quantity of water to the best advantage for flushing the house pipes. The opening, however, should have a strainer and the outlet pipe a trap near the same.

All the above mentioned receptacles of refuse should have glazed or smooth surfaces and rounded inside corners and edges, which avoids to a great extent the retention of filth. The material should be non-corrosive and non-absorbent. They should be placed in the apartments in such a manner that all the parts are exposed to view and to a free exchange of air. No greater mistake is made than to place tight casings around the water-closets and sinks. A ready proof of this is had in the foul odor emitted from such enclosures when they are occasionally opened. Modern plumbing appliances can, without objection, be left exposed to view. The space below them can have a free exchange of air, and being open, is more likely to be cleaned by servants than when hidden from view. From the fact that dripping is likely to occur under all the above receptacles, it is common to put a tray or "safe" below them, to prevent the water from soaking through the floor. Drip-pipes leading from them should never be connected with the drainage system, as they sometimes are, often permitting the foulest air to enter the room through a dried-out trap; but they should be led either immediately outside of the wall into a rain leader, if this is trapped, or into the cellar.

Before leaving the subject of receptacles I should say that it is best to have as few of them in the house as convenient—not because there is the slightest danger to be expected from them when properly fitted, but because they add expense out of proportion to the benefit. It is better to have a whole family to use one closet than two or three, because the one gets two or three times as much flushing,

and is therefore kept in a better condition. The same holds good of wash-basins, where a long disuse might, in addition, permit the water in the trap to evaporate and allow sewer air to enter the room. The fewer the fixtures, the fewer generally are also the vertical soil, waste and ventilating pipes, which reduces the cost and simplifies the system.

It should be further said that to preserve a sanitary condition of a house it is economical to use none but the best appliances. No saving of expense in this direction justifies the use of poorer ones. The best water-closets, I should add, are among the wash-out and valve patterns. Next comes the short hopper and plunger closets. Special circumstances should decide the selection in each case.

Roughing in of plumbing work for water supply to the new electrical fountain in front of Crystal Palace, near London, just installed by B. F. Shaw & Co., of Wilmington, Del. From photograph loaned us by Thomas Kelly, of Chicago.

For further description see page 59.

II. The Traps.—After having examined the various receptacles and mentioned that each one should be trapped as near to the fixture as possible, it now becomes necessary to speak of the traps themselves more in detail. Generally speaking, a trap (and I confine myself to the water-seals as the only reliable ones) is formed by a small depression or dip in the pipe, in which water is retained in order to prevent the passage of air. An endless variety of devices, purporting to accomplish this end, have been put into the market. A main requirement, however, of traps (as well as of the entire drainage system) is that there shall be no accumulation of matter and no deposit, and this condemns at once a large number, particularly the so-called "D" traps and bottle traps.

Another requirement has of late been urged, on the ground that gases are absorbed by water, and that in the case of the sewer trap, gases from the sewer side might pass through the trap and escape on the house side. Dr. Fergus, of Scotland, was a strong advocate of this theory and supported it by a series of experiments. In compliance with this view a number of mechanical traps were proposed, which, in addition to having a water seal, were to prevent the escape of gases by means of a rubber or metal valve. This mechanical seal was at the same time to protect the trap against siphonage. Later experiments, however, especially those made by Dr. Wernich and Dr. Carmichael, show conclusively that, while the above proposition holds when the gas experimented with is in a very concentrated form (as used by Dr. Fergus), it does not hold good in the actual case of the sewer, where the concentration can never

become great, even under quite unfavorable circumstances. Where sewer pipes are ventilated no transfer whatever of gas occurs. But even under adverse conditions and when gas actually penetrated the trap, Dr. Carmichael found that germs and spores in the water trap, however minute, did not pass through it. This result has been amply confirmed, and we can safely return to the old and simple water seal as being a reliable barrier against the passage of injurious matter when the house pipes are properly arranged.

Traps are, however, exposed to mechanical difficulties which must next be considered. They are apt to lose their seal from two causes, by evaporation and siphonage.

Evaporation is likely to occur during the summer months if the traps remain in disuse for a long time. Two remedies are at hand. All plumbing fixtures in unoccupied apartments should be used at least once at stated intervals, to replenish the traps, or they should be disconnected with the pipes entirely. The latter, however, will hardly ever be necessary, as the period for replenishing the traps can be lengthened to many months, if not a year, by having deep seals to them, by replacing the water with oil, and closing the outlet of the fixture with a stopper.

O. D. PECK, OF CHICAGO.
President of Peck Bros. Company.

The loss of the seal by siphonage is a much more important matter, as it occurs under conditions not readily seen or recognized, while the conditions for evaporation are readily perceived. A trap can be siphoned either by the momentum of falling water, sweeping through and out of a trap, or by a compression or rarification of air on one side as against the ordinary atmospheric pressure on the other side of the trap. Numerous observations and experiments are recorded showing how readily, under quite unsuspected conditions, siphonage may take place.

To guard against losing the seal by momentum, the only remedy is to have it as deep as possible and to destroy the momentum by making an abrupt change in the direction of the flow. Long hoppers are more likely to lose their seal in this way than any other fixture. Traps or small discharge pipes are not so much subject to this danger, as the momentum can only be comparatively small.

Far more important is the loss of seal by uneven pressure on the two sides of the trap. It will readily be seen that falling water in the discharge pipes, especially when almost filling them, will tend to compress the air below and rarify the air above. If equilibrium of pressure cannot readily be established in the pipe, it will establish itself by drawing out the seal of the upper and forcing out that of the lower traps. As this is an essential point to guard against in every drainage system, it becomes necessary therefore to provide quickly for both an escape and a supply of air throughout the whole system of pipes.

To determine the degree to which this is necessary, under varying conditions, various experiments have been made, notably those of S. S. Hellyer, in England, of Edward S. Philbrick and E. W. Bowditch, and of Col. Geo. E. Waring for the national board of health.

Mr. Hellyer was very careful in his experiments, and selected such conditions as occurred in his practice. He examined the cases when water-closets, baths, sinks and wash-stands were placed over each other and connected with the same soil or waste pipe. The diameters of the waste pipes experimented with were 1½ and 2 inches, while those of the soil pipes were 3 and 3½inches. The water was poured into the receptacles under varied conditions, and the results pointed positively to the necessity for guarding against siphonage, and that every trap or branch from it should be connected with the open air in addition to the ventilation required for the main pipe itself. His conclusion is given in the following words: "Where tiers of traps of any description are fixed upon one main pipe for receiving discharges from water-closets, slop-sinks, baths, quick-waste lavatories, etc., each individual trap or branch must be ventilated, if the traps upon the piping are to maintain their seals intact."

Messrs. Philbrick and Bowditch, in their report to the national board of health, give substantially the same conclusions, as determined from their own experiments, which were more varied in their conditions than either Hellyer's or Waring's. They were also much more in conformity with actual practice in America than Hellyer's, and more in accordance with what we consider good plumbing than Waring's experiments. The more detailed conclusions may be stated briefly as follows:

Long hoppers should have a vent applied at the crown of the trap, as large as the soil pipe (4 inches) for at least one foot above the trap. Without this vent they were easily siphoned by a single bucket full of water.

Short hoppers with a trap above the floor should have a vent pipe at least 1½ inches in diameter, if more than a few feet in length and larger if passing to other floors above.

Whenever branches are led into a vertical waste or soil pipe with receptacles above, there is also a considerable risk of having the water seal of the trap destroyed, especially when it is shallow and has an easy bend and when the diameter of the discharging pipe is not much larger than the branch. It therefore is necessary to guard against this contingency by connecting the crown of such traps with the open air above the roof.

If the outlet of the main pipe is trapped and no fresh air inlet exists inside of it, the pouring in of water from the fixture can force out or blow out the trap of the fixture situated below the same. It is therefore necessary to provide means for the escape of air below the lowest receptacle.

The friction of air in small pipes is likely to cause its compression and a consequent forcing of traps where such compression occurs. It is therefore better to avoid special long and small descending pipes and lead all fixtures on upper floors directly into the soil pipes.

Among the different kinds of traps the S trap and P traps are the most easily siphoned, yet they are the least likely to retain any filth or deposit, because being simply a bent pipe, the water has a free flow through its entire bore. The round and bottle traps retain their seal much longer, but they cause eddies and always contain filthy deposits. They should only be permitted in old houses, in places where the introduction of a vent might be very inconvenient or costly.

Ventilation of traps is of no less importance in pipes smaller than four inches in diameter. The experiments showed that even a 2-inch S trap with 1⅝ inches seal, discharging into a 2-inch waste pipe, open at the top, loses its seal by having one pint of water poured into it.

"The best and most simple remedy for the siphoning of traps in most cases is undoubtedly to be found in the introduction of air at the normal pressure at the crown of the trap." The experiment showed that below the crown a vent will not be efficient.

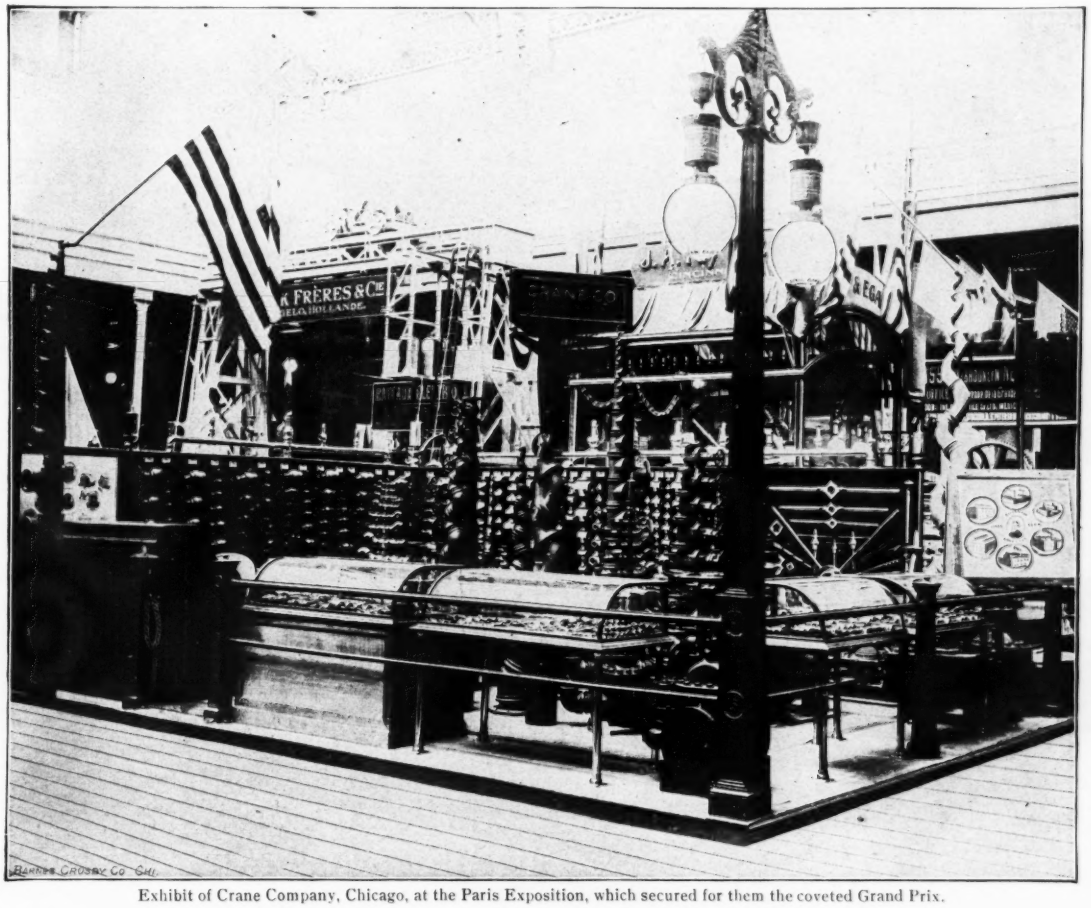


Exhibit of Crane Company, Chicago, at the Paris Exposition, which secured for them the coveted Grand Prix.

"No definite rules can be given for the size or length of vent pipes. Yet it may be said that it is not safe to trust a vent pipe of less size than that of the trap it is to serve until we get above two inches in diameter, unless they are of only a few feet in length, before they join those of a larger size. Generally speaking, if vent pipes are long their diameter should be as great as that of the pipe ventilated; if but a few feet long, a smaller diameter will answer."

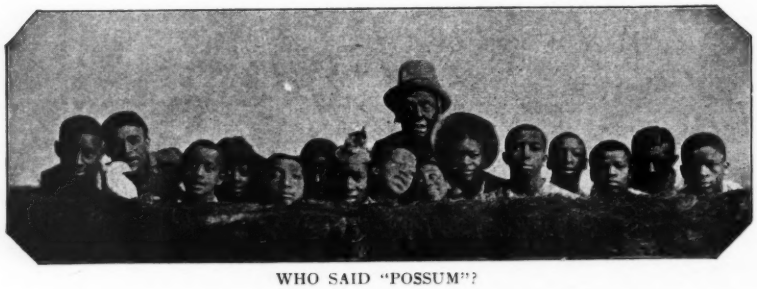
The experiments made by Col. Waring led him to very different conclusions. He states that "the separate ventilation of traps, where the main soil pipe is four inches in diameter and opened at the top, is unnecessary." Such a

conclusion, contrary to all previous experience, naturally required verification, and it was therefore gratifying that Messrs. Philbrick and Bowditch were engaged by the national board of health to undertake the work, the results of which have been just mentioned.

Their experiments were conducted from an entirely different point of view. They show how and under what conditions the seal of traps were lost, while Col. Waring showed rather under what conditions the seal of traps were retained, a less valuable object, in my opinion, as it does not indicate so well the degree of danger to which the various arrangements are liable. Col. Waring's experiments were also much less varied, and the appliances which he himself considers superior to the ones experimented with were not subject to a proper examination. He used pan-closets, through which the water was introduced and which considerably break its force, and therefore siphonage is avoided much more readily than in a hopper closet. And he confined himself principally to the examination of the effects of different patented waste water traps under various conditions, but under the constant one of discharging through a 1½ inch waste pipe, several feet in length, into a four inch soil pipe. The particular traps experimented with had partly also a much deeper seal than ordinary traps, therefore naturally resisting siphonage to a greater degree. The S traps, which are the best, were not sufficiently experimented with, yet they are more readily siphoned than any other trap. This omission, which was afterward filled by the experiments of Messrs. Philbrick and Bowditch, undoubtedly was the main cause for Col. Waring's conclusions.

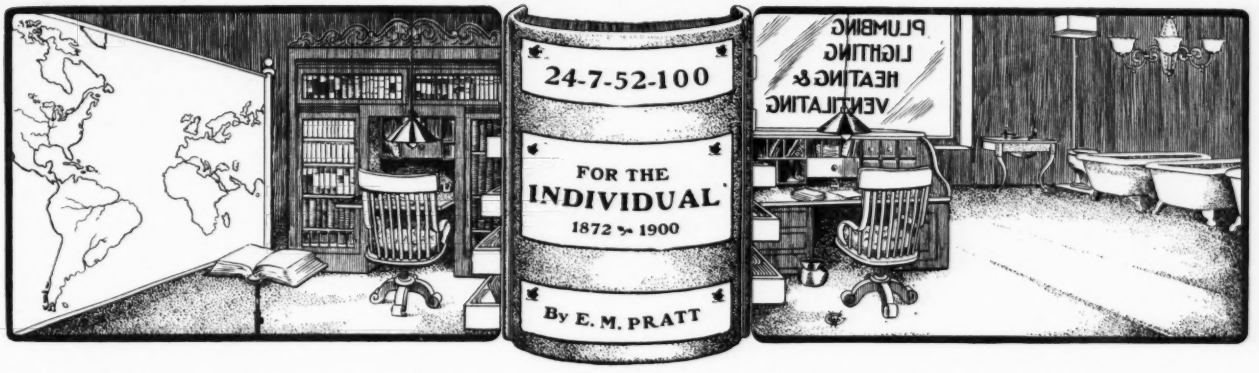
In a later paper he still maintains his former position, confessing, however, that while he does not believe in trap ventilation, he is "by no means clear as to the best substitute for it in all cases." While asserting also that "it is a make-shift attended with possible dangers at least equal to those which it is intended to remove," he in no way indicates even what he supposes these dangers to be. In the face of the experiments just alluded to, which positively show that trap ventilation can be made a perfect safeguard against siphonage, he remarks in a most uncertain strain, as follows: "So far as I can judge from all that has yet been said and done, the best solution of the difficulty will be, if it can be made practicable, to allow the use of no trap of any kind nor in any position which is not in full view whenever the fixture, is used, excepting, perhaps, certain subsidiary traps on kitchen and laundry wastes. If we can trap our wash-basins in such a way that the top of the water seal shall be always in view on looking into the bowl, and our bath-tubs in like manner, we will, I think, have secured the necessary safeguard, and we will have gained the further advantage, that persons of tidy disposition will see to it that a sufficient amount of fresh water is always passed through them to insure their constant cleanliness."

Granted that the "ifs" could be fulfilled, it would be an evil day for the general community to make the safety of traps depend so much on their being exposed to view. Siphonage occurs instantaneously, and the sewer air escapes until the next time the fixture is used, not waiting until persons of "tidy disposition" discover that the seal is lost. To speak in his own words, fixtures should always be not "pretty nearly safe," but "entirely safe."



WHO SAID "POSSUM"?

Sample of half-tone work by J. Manz Engraving Co., Chicago.



Let the big book of drawers full of envelopes represent the medium between you and me. Imagine that the drawers slide both ways and that the envelopes are alphabetically indexed on both sides. My work is to go into all the world to collect better personal, professional and commercial methods useful to you in your work. This page is for the exchange of questions, answers and experiences.

II.

BECAUSE I loved to study local historical events I went to an old merchant friend and asked him if he wished to join hands with me in starting a local history magazine.

He replied that he did not, but he would like to know something about advertising, as he was spending money every year for it and could not tell what it brought him.

Shelving my pet subject to season for an indefinite time, I took up his suggestion, and went from Denver to Boston interviewing men and studying methods. After spending nearly all my money and two years of time, I invited several hundred men, women, friends, strangers and young people to join with me in forming

THE SOCIETY OF ECONOMIC RESEARCH.

The object of the society was to collect and exchange scattered and unrecorded useful information. There were to be no meetings, no assessments and no publicity to members. This was in 1892, and that year I printed the handbook, "Business—How to Get It, How to Keep It." Here are some extracts from it:

Observe, think, read, question and record. One thought written means another thought born.

Social manners have an influence upon the cash box. People, especially the disagreeable, enjoy sunny natures, and it is a big lever in the hand to be able to throw in good manners, cheerful words, and an animating countenance. Employees and letters, even the atmosphere of a business house, possess the individuality of the source of control. Customers are influenced by these forces more than by some things which call for frequent cash payment.

Employees advertise for good or evil all the time. They are the watershed of loss and gain. Good ones are strong mediums for promoting trade. They are the spokes in the wheel of finance. The waiters for quitting time and pay day have ruined thousands.

Catalogues are something like advice, not to be given away unsolicited. Catalogues are necessary in many kinds of trade. They are good advertisers, save time and trouble and are often as good as an agent, but those who have used them very much do not scatter them wildly. In pushing them a circular is sent saying that one will be mailed upon request or for postage.

Fear shop-worn methods worse than shop-worn goods. There are cases in which novelties and schemes bring great returns, but it is artificial business, and a hard way to keep pushing trade.

Have something to say and say it, is a good rule for writing advertisements. Beware of feeble attempts.

Pleasant refusals to solicitors are often remembered longer and prized higher than some orders are. There is too much growling and too little grace in the business and professional fields.

Don't jump to conclusions. Think over the pros and cons. Debate both sides. There is such a thing as voluntary delusion when one is anxious that certain things should be so and so anyway.

A successful singer says that one must have more than a fine voice in this age of the world in order to be heard.

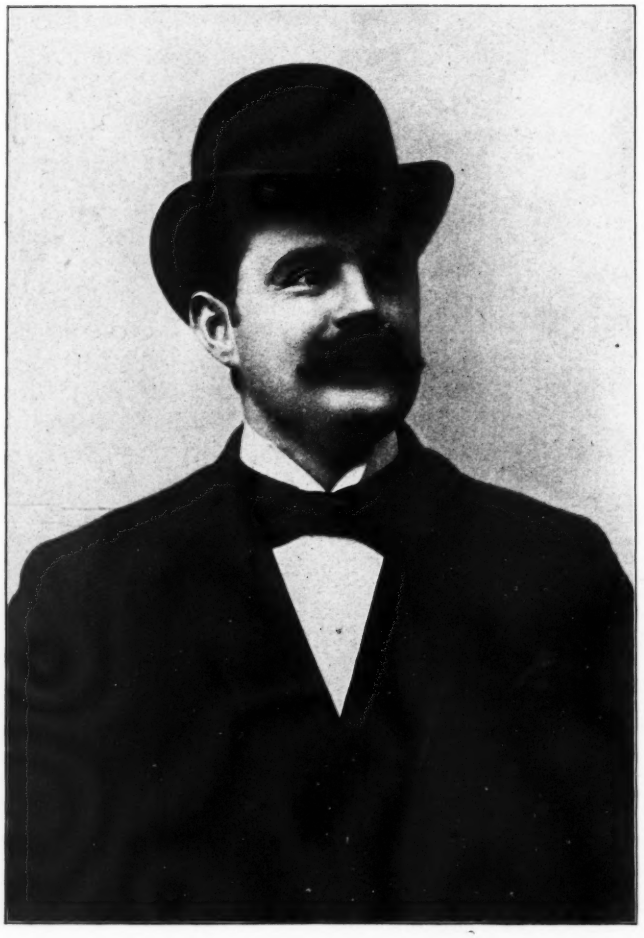
A retailer in America says: "To discontinue an advertisement is like taking down a sign. If you want to do business you must let the public know it. I would as soon do business without clerks as without advertising. I never in my mind used such a thing as a poster or handbill. My plan has been to buy so much space in a newspaper and fill it with what I wanted. I lay aside the profits of a certain line of goods for advertising purposes."

I have seen each one of the following, the leading cause of failure: Inexperience, lack of capital, speculation, overcompetition, amusements, gambling, drunkenness, family expenses, disagreeable manners, fast living, dishonesty, false economy, old age, poor health, dishonest employees, fire, and poor management. Other observers probably know as many more.

Choose a few methods of promoting trade and become skillful in them before spreading.

I read an advertisement for years before buying the article, but a friend who had never heard about it began buying as soon as he saw my purchase.

It was fortunate for me that I postponed my historical magazine, which was not needed, and took up business methods, for which there was a need and a want. But I found out that people would pay their money and enjoy the reports without helping collect the information. The latter was the main object of the society, and I allowed it to drift into a department of my research work. It is alive and taking care of the subject—the Origin of Originality. The daily sources of profitable new ideas is a very lively and interesting subject, and it has a good many friends.



THE LATE GEORGE E. BOYLSTON.

Died Nov. 27, 1900.

THE LATE CHARLES SPENCER LOCKE.

Freezing of Soil and Vent Pipes.

EADING plumbers in various cities were asked by letter for their views about the freezing of soil and vent pipes. They responded promptly and the result forms an interesting chapter on one of the most difficult problems the plumber in a cold climate has to solve. The inquiries to which replies were requested are as follows:

1. Do soil and vent pipes which project above the roof freeze in winter?

2. If the ends of these pipes become frozen will the fixtures and traps below be siphoned?

3. If the traps are siphoned, will sewer-gas escape through them into the rooms of the house or factory?

HALF TONE PLATE BY BLOMGREN BROS. & CO., CHICAGO.

MISS FLORENCE McVEY, LIMA, O.

A young business woman, who at 16 years of age, is financial and corresponding secretary of the business of her father, J. M. McVey.

4. Is it dangerous to stop up the end of soil or vent pipes at the roof, by freezing or otherwise, considering them as vent pipes?

5. In the winter months is it safer to leave the ends of the soil and vent pipes uncovered, or to put cowls on them where they leave the roof?

Affirmative replies were given to the first four queries, and to the first clause of the fifth, by nine-tenths of those written to. Some give descriptions of devices they have contrived with a view of overcoming the difficulty, and others qualify their answers in a manner to show that they are workers with head as well as hands. Of the latter class is a veteran New York sanitary engineer. After answering the first quartet of queries susceptible of reply by a simple negative or affirmative, with the latter, he says: "The fifth question is susceptible of two answers—to and including the word uncovered: Yes. The putting on of cowls or return bends should not be done, as both will freeze when the thermometer is at or below zero. We use something of our own manufacture, a funnel-shaped extension of the soil pipe when it passes the roof line, made of galvanized iron and the top covered with wire netting. This style was tested one year ago last winter. There was on the house a return bend, a cowl and a funnel-shaped extension with wire cover. The cowl and return were on, and we did not disturb them, but in putting out new lines of air pipes we put on funnels. During the month of February we were on the roof with the thermometer standing at 7 below zero. The cowl and return bend were both frozen solid, while the center of our funnel was clear and open."

A plumber in Buffalo, N. Y., replies fully to each interrogatory as follows:

"1. If the house drain is connected to the main sewer without a stench trap between the soil or vent pipe and the main sewer, the steam and gas from the main sewer being drawn up the vent or soil pipe it will freeze above the roof in winter.

"2. They will siphon.

"3. If the traps are siphoned the gas will escape through into the rooms of the house or factory.

"4. If the soil or vent pipe becomes closed at roof the gases are liable to be forced through the traps in rooms when the closets are used and discharged, and is sure to be forced through the traps in case of a storm suddenly filling the main sewer and forcing the sewer gas up the house drain and through the traps.

"5. The end of the soil or vent pipe above roof should be covered with a cowl.

"I have applied for a patent for shutting all sewer gas from the main sewer in the house drain by a new trap which I have invented. I have used several of these traps, which can be inserted in the house drain and free access had to the house drain to clean it out in case of stoppage without opening the sewer, and at the same time to ventilate the house drainage so as to overcome all the difficulties noted in your questions."

A Chicago plumber replies with characteristic care and exactness in the following conservative manner:

"In answer to first question would reply: Yes, when they are utilized as out-flow vent pipes, and not protected or surrounded by a warm current of air or smoke, and no, when they are utilized as inflow vent pipes, where the soil and waste pipe ventilation is tributary to a stand pipe constantly heated.

"In answer to second question: Yes, when the volume of flowing waste water is such as to fill the waste pipe, or when the volume together with the spray is sufficient to fill the waste pipe, or when the body of water flows very rapidly down the pipes, thus preventing the air regaining its density at the crown of the traps or should there be a trap at the bore of soil or waste pipe when the air within

CHRISTMAS BELLS

This plate is a sample of half-tone engraving by the Illinois Engraving Co., of Chicago, Ill.

such confined space would be rarified to the extent of the volume of air the water will carry with it, or should the temperature of the confined air be reduced.

"In answer to third question: Ordinarily, yes, but not in all cases. When the weight of air within the room is greater than that within the waste pipe, the air will flow into the siphoned trap from the room into the waste pipe. This is the principle that should be thoroughly mastered and applied to the ventilation of buildings. In order to properly explain this statement, it would require more time and illustrations than I can give it at present.."

To the fourth query he answers in the affirmative, and to the fifth: "I am opposed to all kinds of cowls on top of ventilation pipes in winter."

A plumber of Washington, D. C., where the zero line is seldom reached, writes thus:

"1. It's only within the last ten years that it has been the custom to extend soil and ventilation pipes above the roof in this city, and I have never known or heard tell of one freezing in this latitude.

"2. If the fixture above was a valve, plunger, or siphon closet? Yes; but with a washout, hopper or pan closet, the seal in all probability would be broken.

"3. With the soil or vent stopped at the roof and the trap siphoned. If the temperature of the inside of the house was sufficient to put in motion the air in the soil or vent, it would undoubtedly enter the rooms in which various fixtures, traps were unsealed.

"4. Most undoubtedly! Especially when the soil and vent pipe and fixtures are not tested to know whether they have imperfections or not.

"5. In my opinion it is better to have the soil or vent uncovered and unobstructed by anything, letting the air have a free and unobstructed passage through their entire length, with the least change of direction possible."

Another Chicago plumber answers all the questions in the affirmative, emphasizing his replies to Nos. 1, 2 and 3, and adding, "In reply to the fourth inquiry, I would say it is most certainly dangerous to stop up vents or revents in any manner whatever. As soon as they are stopped they are no earthly account for what they are intended. If your vents or revents are going to be stopped up where they pass through the roof, by frost, you may as well block your job off at the highest fixture in the old-fashioned way.

"No. 5. In the winter months, there is the rub, Mr. Editor. Cowls on ventilators diminish the air space, when to enlarge the air space should be the rule. All vents or revents should be enlarged where they pass through the roof. Enlarge all vents and revents as you go through the roof, take the cold air inlet at the curb, and chuck it to the bottom of Lake Michigan, and you will have a better and safer job of ventilations in this climate than you do now."

A St. Paul, Minn., plumber places a similar "yes" to the first four questions. To the fifth he replies by saying that he uses, with good effect, to prevent freezing, "an extra casing of galvanized iron about the vent and soil pipe above the roof,letting it extend above the ends of the pipes about a foot." The vents are increased from two to four inches before passing through the roof.

Another plumber from Washington, D. C., has not found the frost to interfere with the soil and vent pipes in his vicinity, owing to the mildness of the climate on the Potomac. He returns affirmative answers to questions 2, 3 and 4, and says in reply to the last on the list. "Leave them open, no cowls; cowls are for looks, and not useful."

A veteran Chicago plumber says pipes that project four inches above the roof, freeze in winter, but that if the plumbing is properly done, the fixtures and traps will not be siphoned. He has found cutting the pipes off near the roof, or perforating them where they emerge therefrom, has caused complaints to cease, and has been apparently successful.

Another Chicago man replies fully as follows:

"1. Yes, and that is the danger of our modern plumbing.

"2. Yes, and this is very dangerous, as it will poison the inhabitants with sewer gas.

"3. Yes, and from that source two-thirds of our infective diseases take their start.

"4. Yes, and we must prevent their freezing up to make the plumbing safe.

"5. Do not put any covering on them; by putting cowls or otherwise covering them the danger is increased."

A gentleman in Baltimore answers the first questions in the affirmative, and says in response to the fifth: "I consider it best to make a close connection around the pipe as it passes through the roof, and then place a hood over the pipe, resting on the roof, leaving two inches air space, with sufficient space at top for circulation."

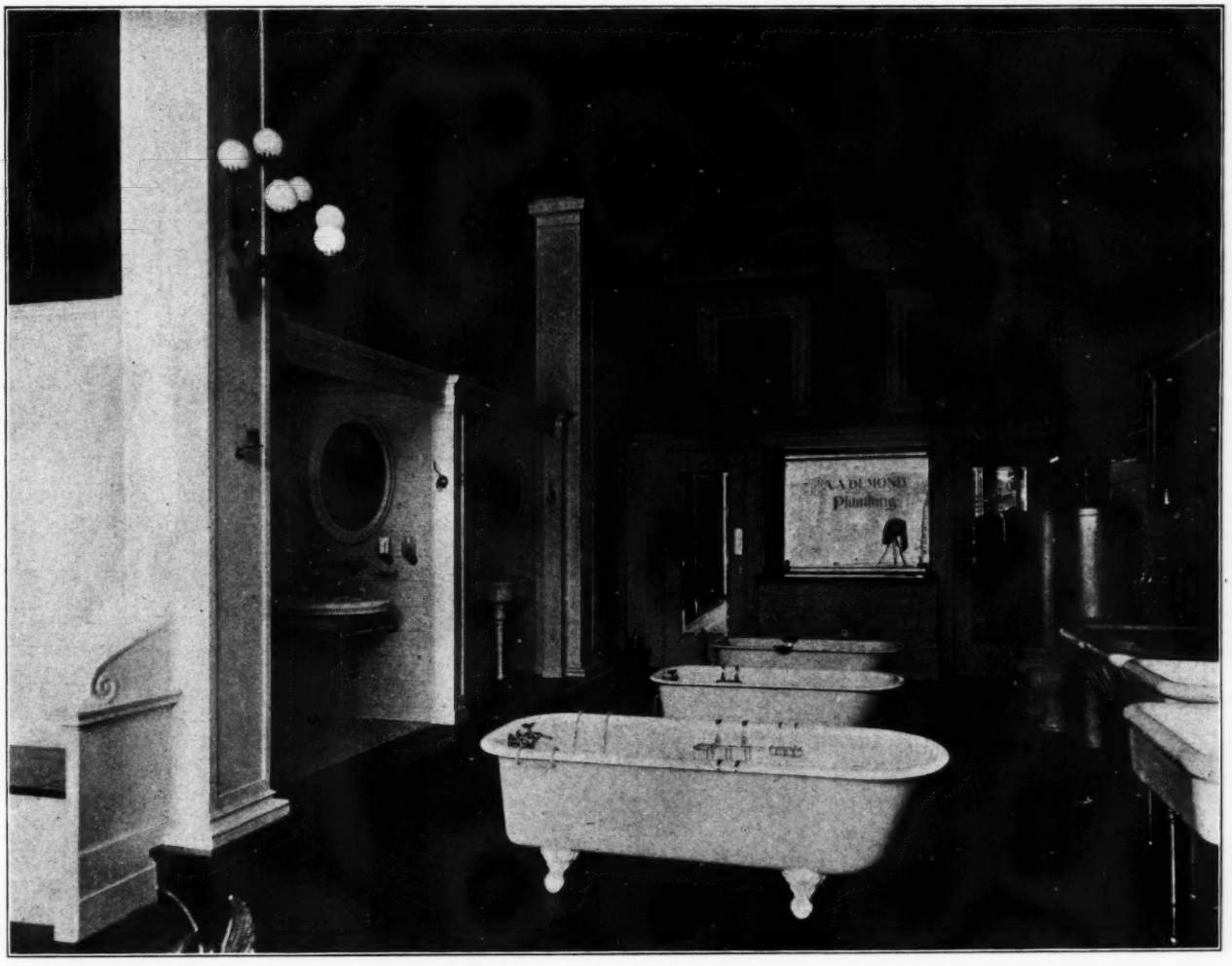
One of the oldest plumbers in Chicago reports that in his experience the pipes in question only freeze "in very severe weather, and a long extension of pipe above the roof." To the second question he replies: "Not always; depends altogether on style of closets used; with a plunger closet they would be very liable to siphon." To the other questions he says "yes."

Replies stating in substance that in the cities written from freezing seldom or never occurs, but endorsing freedom from cowls or return bends were received from Wilmington and Dover, Del., New York City, Boston and New Haven.

Practical Plumbing.

Read by a Master Plumber to a meeting of young Architects.

THE architect may expect and will be forgiven for mistakes and lack of harmony in the exterior finish, and for inconvenience and discomforts in the interior layout of the house, but I have grave doubts of his forgiveness, here or hereafter, for the misery and discomfort of an unhealthy home. The plumber, while often responsible for bad plumbing, is, I believe, in the majority of cases, willing and anxious to do right, but is hampered by considerations and circumstances over which he has no control. Therefore, I repeat that to future architects practical plumbing is the most serious and important subject that can engage your attention.



HALF TONE PLATE BY INTERNATIONAL ENGRAVING CO., PHILADELPHIA.

Plumbing Establishment of A. A. Dumond, Rochester, N. Y.

It is a subject of so much importance and contains within itself so many interests that I undertake its consideration with diffidence. But encouraged by twenty odd years of practical experience, the only safe guide in plumbing, I hope, with your kind indulgence (not so much for what I say as how I say it) to throw some light on the subject. You know Chicago contractors, and especially plumbers, have not much time to devote to cultivating anything but the practical, that after devoting fifteen hours daily trying to come out even with the architect and owner there is not much time left to prepare for such an undertaking as I have presumed upon this evening. I have thought best to devote my attention to the most important feature of our subject—sewer, waste, soil and ventilation pipes.

That I may make myself clear and intelligible, let us suppose that I am getting built a home. If the house occupy the entire lot, my sewer would, of necessity, have to be inside, in which case I would run the sewer, as is the custom now, to within a few feet of the house, where I would have a man-hole large enough to allow a man room

to work in. There I would have the sewer-builder's labors cease and the plumber's commence.

Where the Plumber's Work Begins.

From this manhole I would continue, in a trench built of brick for this purpose, a six-inch lead soil pipe to catch basin in rear (unfortunately we are compelled to have such nuisances in Chicago), with four-inch branches for closets and 1½ inch for basins, with hand-hole openings properly

W. A. RATCLIFFE, OF CHICAGO.
Secretary and Treasurer of Peck Bros. Company.

arranged, all in trenches or such way that they could be got at without destroying floors and casing and creating such general havoc as is now necessary to make the slightest repair.

Going Upstairs.

Our ground work now in, we proceed with our soil pipe, for which I have had the architect provide eight-inch partitions over each other so as to give me a clean, straight run from basement to roof. In this partition I would have a recess large enough to accommodate all my pipes running to and from basement. In this way the plumber would not have to be coaxing the carpenter to take out a header here and put in one there. I would increase my soil pipe through roof one or two sizes. The soil pipes I would carry right to the center of the recess resting on brass lugs, soldered on the pipe and supported by regular pipe rests.

There should be none of the old-fashioned flanges on floors or straps on pipes; pipes at floors should be clear and all supports should be so placed as to give the utmost freedom in examinations. Plumbers given this opportunity and requested to put in extra heavy lead soil pipe, would send their best men; no others would be of use.

The Present Practice Reversed.

The practice of to-day would be reversed, the expert, skillful workman would be sent to do the "roughing in," while your young, neat workmen would get the finishing, where they would be least liable to make mistakes and where such would be easily remedied if made.

We have now our soil pipe complete from man-hole to roof, and proceed to test it by plugging it in the man-hole and filling with water to the roof. What a pleasurable job this would be to the plumber in comparison with his task of today!

The Ideal Job and the Actual.

Let us compare, for a moment, this job of lead soil pipe run in a nice recess large enough to carry all the pipes to and from the bathroom, with a nice panel board cover set on with round head screws, or hinged so that there will be no defacement or trouble in removing it, and the universal practice of to-day of having everything iron. In the first place all iron pipe for plumbers' use is of a very inferior quality, the purposes for which it is used and the habit of burying it out of sight, and above all, the desire for a cheap article gets the manufacturer to where he is compelled to turn out a very worthless article. Besides this, the habit of tarring it or covering over the sand holes and cracks by the time the plumber gets through with it trying to fix up a sand hole or defective caulking here, and a split pipe or fitting there, it forms a very poor and dangerous job, liable at any moment to give way at some of its many weak points.

But if there is such danger with the iron pipe that has been put up carefully and tested, what can we say of the miles of it put up by careless, inferior labor without any test?

How to Realize What Iron Pipe Is.

Gentlemen, there is only one way of forming any conception of this great danger, and that is to examine a load of soil pipe and fittings as they are delivered at a job or at the plumber's shop. The knowledge you would there get would be entirely sufficient to settle for all time any doubt there might be on your mind about the fitness of this stuff for soil and ventilation pipes.

The only objections that I have ever heard offered to the use of lead are that the rats gnaw it, carpenters drive nails through it, and it costs a little more.

Now, properly run, the first two are entirely avoided, and as for the last, it is only in keeping with the man's idea of things who told me some days ago, when I recommended replacing an old pan closet that was within ten feet of his bed with something modern, "No, fix it up; these new arrangements cost too much. Put in a new pan, and we will take another year out of it." At the same time there were painters and decorators in the parlors trying their utmost to give the neighbors and friends of this house an idea that this poor, foolish old fellow was a man of fine susceptibilities, fine feelings, etc. Well, he was not; notwithstanding that, looking at the parlors you would not have thought that the old pan closet was good enough so long as it could not be exhibited and give the owner a reputation for wealth and good taste. Cost, I think, should not be considered in such an important matter. If the plumbing is not right in

a house, certainly nothing else is. If the house is unhealthy, the doctor's and undertaker's bills very soon reach what the perfect job would have cost.

The Bathroom as It Should Be.

In the bathrooms I would place immediately under water-closet a large lead-lined box, sufficient to accommodate the nest of pipes and bathtrap usually located here, and drain bathroom safing too. Over this box I would place a marble slab in such a way as to be easily removed to admit of inspection. If the closet is to be closed in, which, I think, is preferable for private houses, I would only have sufficient covering over this box to bolt my closet to. In this way the entire network of pipes would be visible by opening the riser of the closet, which ought always to be hung on hinges from the top with only a button on the bottom to keep it closed.

Everything in Sight.

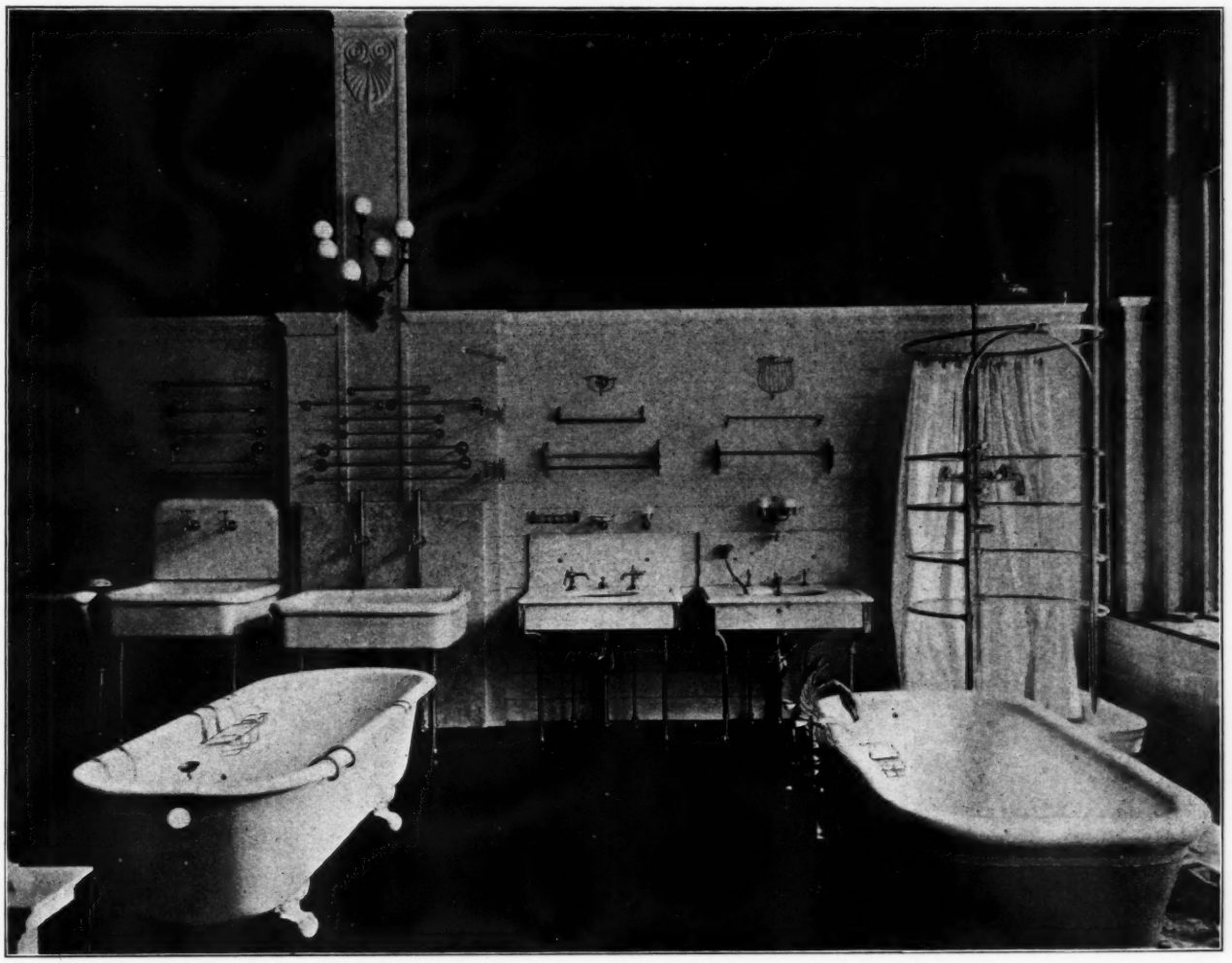
The fixtures in the bathroom ought to be so arranged that the entire piping will be in clear view. The waste from the bath ought not to be more than 1½ inch, and from the basins 1¼ inch. Bath and basin plugs, as they are made at present, are very faulty in having such small openings. They should be enlarged so as to fill their waste pipes and thoroughly flush them.

Faulty Kitchen and Laundry Wastes.

The present practice of running kitchen and laundry wastes is simply abominable. It is hard to conceive why any man in his senses will run a six-inch earthen pipe from a sink or set of laundry tubs when the opening in these fixtures are not sufficient to thoroughly flush a 1¼ inch one. These wastes should not exceed 1½ inch. They are usually in such a position that they can have a good grade, and whatever their grade they will keep clean longer than a larger filthy six-inch pipe will.

The Danger in Large Earthen Pipes.

But the great danger with this large earthen pipe is that it will clog up and, the joint below the floor being cement, or, as the health department now insist, elastic cement or asbestos, a very small head of water or pressure from within will force this asbestos or elastic cement joint and allow the entire waste from the kitchen and laundry to run under the house until the odor from the accumulating filth gives warning of something being wrong.



HALF TONE PLATE BY INTERNATIONAL ENGRAVING CO., PHILADELPHIA

Plumbing Establishment of A. A. Dumond, Rochester, N. Y.

Lead Pipes From Fixture to Street.

Gentlemen, if you would see a couple of hundred houses every year for twenty years the entire area underneath of which was covered with a few inches of seething, rotting sewage, the result of broken soil pipe and sink waste connections with the sewer, you would never permit in your practice, you would never allow in the house that you were to be responsible for and to whose owner you promised to give a healthy home, a cement joint, an asbestos joint or an elastic joint. You would have the joint that common sense recommends, that experience, the only guide and safeguard, in mechanical as in all other matters, tells us is right. You would have lead waste pipe from fixture to outside of house. In that you would have the metal, the elasticity, the durability, in fact, everything but your asbestos, and that you would have supplanted with common sense, which is a most useful and valuable thing to have in the performance of practical plumbing.

Ventilation and Reventing.

Our next consideration is ventilation and reventing, on which there are as many theories as there are sanitary engineers, and I very much fear, as many grievous mistakes made as there are both. In ventilation all seem agreed that the soil pipe should be continued above the roof, increased as it goes.

Why Lead Should Be Used.

To this general practice I have no objections to make, except in the material used, which I insist should always be lead above the highest fixture. It is folly, it is madness, it is criminal, to put into any man's house a pipe to carry off deadly poisons which from the nature of things cannot last long. Yet what can the individual plumber do in such cases? What can the plumbers do without the aid and cooperation of architects? I have taken out enough of defective cast-iron pipe to convince any man not naturally a crank that iron is no material to use for such purposes. Those pipes that I have removed were so thoroughly eaten away that it was almost impossible to save enough out of twenty feet of them for a relic of the iron age in plumbing. None of them were in use more than fifteen years. I have in my office several four-inch lead bends which once formed the connecting link between soil and cast-iron ventilation pipes.

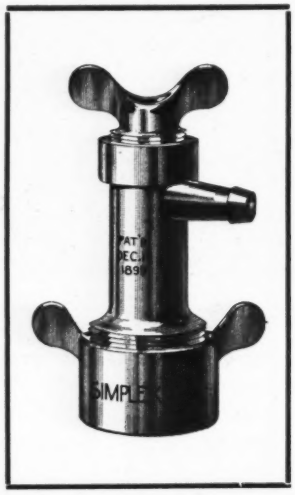
How Iron Bends Fill Up with Rust.

In testing houses to find the cause of the odor complained of, I found in two that, with the peppermint test, we could not locate the trouble, and seeing that there was an offset from soil to ventilation pipe, experience led me to believe that the bend was filled up. To make sure before cutting it out, we tried the water test, filling from roof, and found that the bend was solid. In the other cases the bends becoming defective were removed, in doing which they were found to be almost completely filled up with rust, the ravelings of the iron pipe as it gave way to the effects of the sewer air. These pipes were four-inch, and the ventilation pipe in a couple of cases was not more than ten feet long and had not been in use more than five years. If such is the case with four-inch cast-iron, what can we say or think of the practice of putting in one-inch, 1¼ inch and 1½ inch soft wrought-iron for reventing?

Why Cast-Iron Is Used.

The plumber is not to blame always, for I have fitted up houses where there were porcelain baths and decorated bowls, the cost of one of which would have more than paid for lead for all the ventilation and reventing there was in the house, but the owner felt too poor to stand the additional cost of lead, or probably he might have thought it was only a device of the plumbers to get in a bill for extras, and he did not feel inclined to sacrifice a decorated bowl for something he could not see when plastered up, so the cast-iron ventilation and wrought-iron had to go in. I believe there is more than enough of wrought-iron pipe used for this purpose in Chicago every year to reach from New York to San Francisco, and to what purpose? The cure in this case is surely worse than the disease.

A wrought-iron pipe will fill up so solid at the first turn or bend it gets in a couple of years that there is no ventila-



A CLEAR PICTURE.

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This plate is a sample of half-tone engraving by the Chicago Photo Engraving Co., of Chicago, Ill.

tion, and when it doesn't fill up it will be eaten away so quickly that the more venting and reventing there is, the more danger.

The owner or occupant feels secure, believing that every precaution has been taken to make his house safe, when he would be ten-fold better and safer if there had never been a foot of such ventilation in his house.

Too Much Reventing Unwise.

There is also a practice nowadays of reventing every trap in the house, whether it needs it or not, which I think is very unwise for many reasons, as in this indiscriminate venting and reventing many very serious errors or mistakes are made in what plumbers call "by passes," by which an otherwise fine job of plumbing is made a death trap.

Therefore, while claiming that plumbing has kept in advance of all other departments of the building trade, especially in fixtures and workmanship, I am sorry to have to admit that the benefits derived from this important advancement are only temporary, and I feel no hesitation in saying that the house gets no better security from foul air than it enjoyed without ventilation, and with the old pan closet, the filthiest of all plumbing fixtures.

Advice to Architects.

Consequently I would urge upon the architectural profession to eliminate iron pipe from their plumbing specifications. If you cannot agree with me as to its unfitness for sewer and soil pipe (it may take a few more years to thoroughly demonstrate it), discard at least for ventilation purposes.

I should have probably said something in the beginning about earthen pipe sewer, which I regard as just a very little improvement on the old wooden box sewer. Why, gentlemen, there is not a week passes by that I am not grieved and shocked to see the upper surface of new-laid earthen pipe-sewer made the passage way for all the laborers and mechanics in new buildings.

How Earthen Pipe Sewers Are Laid.

Look at the way it is put into place. At least in half the houses in Chicago the trenches prepared for earthen pipe sewer would remind you very strongly of a farmyard where hogs were let loose for a picnic, a hole here and a couple of feet of trench there, and then another hole, and so through the house. Where there is any depth to go, every shovel full of dirt that can be avoided is left undisturbed. Work cannot be done in such a manner properly, and it is not done. There is no necessity at this late day to use such stuff. There is no reason why the health of families should be subjected to the risk of any material so easily displaced or injured.

About Plumbing Fixtures.

Our next consideration is "Plumbing Fixtures," on which, I am pleased to state, there is very little to be said except in praise. Everything from the sink to bath-tub and their fixings and connections are on the steady advance to perfection.

The new style closets seem to me to possess all the necessary requirements for cleanliness and durability. No closet should be used that a closet brush will not reach to water seal. The servants' closet, which sometimes receives too little attention, ought always to be automatic in its workings.

Removable Overflow Attachments.

Baths and basins ought always to have the removable overflow attachments which allow of the cleansing of those fouling places with which the porcelain, enameled or copper bath is all that can be desired for health and comfort.

Wooden laundry tubs and sinks are fast disappearing, but hardly as quickly as they ought. The new styles, with a 1½ inch lead waste from fixture to catch-basin, will never give any trouble or headaches.

Attic Tanks Recommended.

I would also recommend the placing of a large tank in attic, so arranged that it could be used for a supply tank in case of need, but whose chief purpose would be for flushing soil, waste and ventilating pipes. This would be of very great benefit, and, in my opinion, would prevent in great measure what we may call the "dry rot" in those pipes. With such an arrangement flushing the entire system once or twice a week, there would not be so much foul air generated in house pipes, and householders would be taught the necessity and importance of its liberal use.

Not in Use in Chicago.

I have never seen such an arrangement. I don't think there is one in Chicago, but I believe you cannot have a perfect job of plumbing without them. No house can possibly be clean and healthy without frequent inspection and cleansing of its plumbing fixtures. No plumbing fixture should be used that cannot be easily cleaned in all its parts. This ought to be the chief consideration in their selection.

No house is safely plumbed for any length of time where wrought iron is used for soil or waste, and is absolutely dangerous where used for ventilation purposes.

I believe that every remedy, so far, for coating iron pipes for preserving for plumbing purposes is merely a makeshift, a blind, and does more harm than good in hiding and covering a multitude of defects.

A Guarantee for Ten Years.

Let us suppose that the national association of architects should submit to the national association of master plumbers the following proposition at their meeting: That hereafter all plumbing must be guaranteed for a term of ten years, during which period said plumbing must annually be tested by filling with water from man-hole in front to roof, and if any defects are found, to right them free of expense to owner.

What think you, gentlemen, would be the answer of the national association of master plumbers?

What the Plumbers Would Propose.

I feel very safe in anticipating their answer. It would read something like this:

"Yes, gentlemen, we will do just as you say, on the following conditions:

"That you specify no iron pipe for sewer, waste, ventilation or reventing pipes; that you specify lead instead, and that you require a bond with every guarantee."

This proposition I most respectfully submit to the consideration of the national associations of architects and plumbers, believing and feeling that as each has the one grand object in view, healthy homes for their clients, it is the shortest, surest and safest road to honest, practical plumbing.

A History of Water Closets—I.

By Glenn Brown, of Washington, D. C., before the American Institute of Architects.

WATER-CLOSETS as conveniences are so necessary, and in their proper construction are so important to our comfort and health, that we think any research into their history will repay us by increasing our knowledge on the subject. It will be necessary in this paper to review, cursorily, other modes of convenience in countries where, and at times when, water-closets properly speaking were not in use.

Naturally, we first examine the ruins of Egypt, where existed the earliest traces of civilization, for remains of water-closets. The small private and detached rooms which we find in the remains of Egyptian houses were probably used as privies. Ewbank, in his work on hydraulics, calls the summer chamber of Eglon, king of Moab, a water-closet. If we thought proper to follow the example of Ewbank, we would call water-closets the private rooms which were in an isolated position in one of the halls, being near a door communicating with the other chambers. Sir J. Gardner Wilkinson says: "These rooms bear a striking resemblance to the before-mentioned private room of Eglon."

That the Greeks made use of privies in their houses is proved by an old writer from a passage in Aristophanes (Ecclesiaz., verse 1050). This was about four hundred years before Christ.

The Romans, if not the first in art, the leaders in all that pertained to luxury and comfort, were the first, so far as we can ascertain, to use water-closets. In Rome we find four kinds of receptacles for excreta. Close stools (lasana), in which the rich ancients sometimes used gold or silver bowls; vases (gastra) which were stationed on the roadways; public privies (cloacina), of which Sir William Gell tells us there were one hundred and forty-four in Rome; privies (latrina), probably for private use. From their derivation we would infer the two classes last mentioned to be water-closets, cloacina being derived from cloaca, a sewer

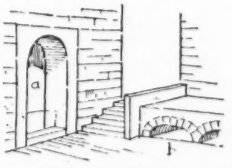


FIG. 1. Privy in kitchen in Pompeii.
a, Niche. *b*, ovens.

or drain, and latrina being a diminutive of lavatrina, a wash-bowl or basin. No doubt, as at the present day, the name included the room as well as the basin or receptacle contained in the room. Pompeii was covered with ashes and lava by an eruption of Mount Vesuvius more than eighteen hundred years ago, and among its ruins were found the most perfect remains of an ancient water-closet. Pompeii being a small town and a province of Rome, we would suppose the water-closets to have been more numerous and more elaborately ornamented in the capital city. In the Pompeiana Sir William Gell, describing a privy, writes of an arched recess about three feet deep discovered in the kitchen of one of the ruined dwellings of Pompeii, most inconveniently placed, according to American ideas (Fig. 1). The wood-work was gone when discovered (about 1819), but the marks of the hinges and fastening were still visible. Three or four feet to one side were the remains of brick ovens. It would appear, according to a quotation from Pretonius, that in ancient Italy it was considered desirable to have in close proximity the place for the preparation of the food and the receptacle for the excreta. The privies in or adjoining the kitchen were probably for the women, while others which have been discovered at the back of the house were for the men. These chambers were sometimes finished beautifully, having tesselated pavements, and in some instances windows looking into small interior courts, an example which the moderns seem injudiciously prone to follow. Fosbroke says, under the head of ancient water-closets: "That of the Palace of the Caesars is adorned with marble and mosaic. At the back of one is a cistern, the water of which is distributed by cocks to the different seats. The pipes and basin of one still remains at Pompeii, and is like ours." (1825 A. D.) In a paper read before the Society of Antiquaries in 1775, relating to discoveries in Pompeii, Sir William Hamilton says: "Close to the temple of Isis is a theater, no more of which has been cleared than the scene and corridor which leads to the seats. In the corridor was a retiring place for necessary occasions, where the pipe to convey the water, and the basin like that of our water-closets (1775) still remain, the wood of the seat only having mouldered away by time." The above-mentioned remains, seen by Sir William Hamilton, conclusively prove the existence of water-closets more than eighteen hundred years ago, with basin, water supply and waste for the water, and excreta must necessarily have been carried off by a drain of some kind.

In all descriptions of ancient baths we find a latrina, that near the entrance of the ruins of one in Pompeii, mentioned and shown in the illustration, but it is in no case fully described. According to Olympiodorous there were in the Thermae of Antonnuis (about 200 A. D.) sixteen hundred seats of marble with holes like a close stool for the convenience of those who attended either the baths or the gymnasium. Vitruvius, strange to say, does not mention water-closets or privies in his description of private houses. Both ancient and modern writers seem to avoid the subject. Ewbank states that a number of water-closets were erected near the mosques and temples in Old Rome, Smyrna, Constantinople, and probably all ancient cities. He does not give his authorities for the statement, and it would appear as if it were a little overdrawn. With the decline of the Roman empire, water-closets, following her other luxuries

and comforts, seem to have gone out of date. Giving a cursory view of the privies used in the middle ages, we leave unaccounted for nearly a thousand years, during which time there seem to have been no privies used inside houses. The castle of Rochester, designed in part by Bishop Gundulph about 1088, has outlets for privies and sinks similar to the outlets for smoke, in the first instance going downward, instead of upward as in the case of their chimneys.

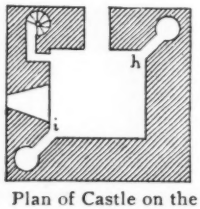


FIG. 2. Plan of Castle on the Peake.
h, Privy. *i*, Well.

In a paper read by Edward King before the Society of Antiquaries (1782 A. D.) in relation to a Saxon castle, he says: "In one of the corners is a narrow passage to a small closet in the wall, which served for a privy, having the usual kind of an outlet through a loop." (Fig. 2.) Diagonally across from the privy is a similar passage and closet supposed to have been a well. This tower or castle was undoubtedly Saxon, having been given by William the Conqueror to William de Peverel, and called the Castle on the Peake. We learn from Viollet le-Duc that castles (chateaux) at the commencement of the thirteenth century had privies (latrines) on each floor, constructed so as to avoid the inconveniences attached to these necessities. They were generally found projecting on corbels, from an angle formed by a buttress and the main wall (Figs. 3 and 4) so

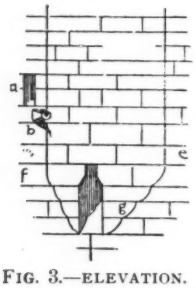


FIG. 3.—ELEVATION.

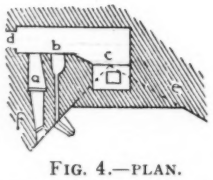


FIG. 4.—PLAN.

THIRTEENTH CENTURY PRIVY.
a, Window. *b*, urinal. *c*, Seat. *f*, Wall. *e*, Buttress. *d*, Door. *g*, Corbels.

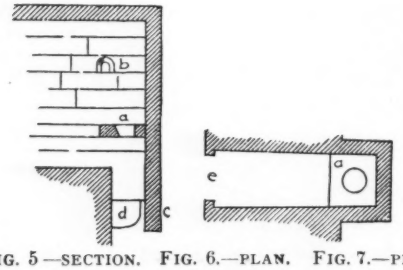


FIG. 5.—SECTION. FIG. 6.—PLAN. FIG. 7.—PERSPECTIVE SKETCH.
LANDSBERG LATRINE.
a, Seat. *b*, Window. *c*, Hanging T-shaped stone. *d*, Corbels. *e*, Door.

the fecal matter might be cast well out and down the precipice into the woods which usually surrounded these buildings. He describes one which is corbelled from a wall and buttress in the usual way. The seat is concealed and protected from missiles by the corbels, and it communicates with the halls and stairways by a door. In the same closet there is a urinal with drain, and a drip on the outside, and also a window opening into the outer air. In the castle of Landsberg on the Lower Rhine, which dates from the twelfth century, there is one (Figs. 5, 6 and 7) that differs from the above. The seat is guarded by a rectangular projection from the wall, which is supported on corbels. The seat is protected from arrows and other projectiles by a stone shaped like a T, which hangs on and below the corbels. In garrisoned castles they always had projections reserved for privies, and they were separated from the main building by small passageways. There are privies of this kind in the castle Chauvigny, while the castle of Northumberland, England, has them, almost monumental in character or design. The castle of Marcousis has an extension

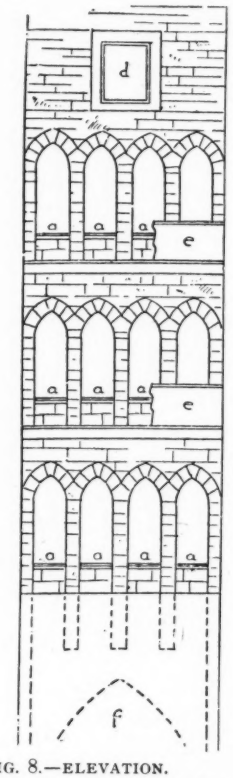


FIG. 8.—ELEVATION.

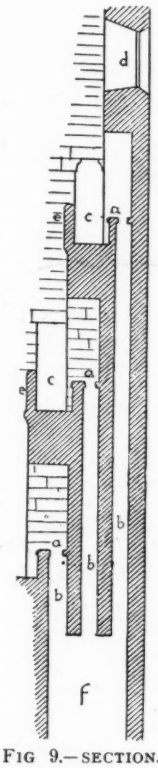


FIG 9.—SECTION.

LATRINES, MARCOUSIS CASTLE.
a, Seat. *b*, Chute or Drain. *c*, Entrance from Main Building. *d*, Window. *f*, Cesspool. *e*, Balustrade.

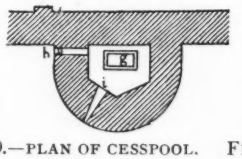


FIG. 10.—PLAN OF CESSPOOL.
h, Door. *i*, Window. *g*, Stone.

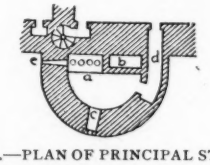


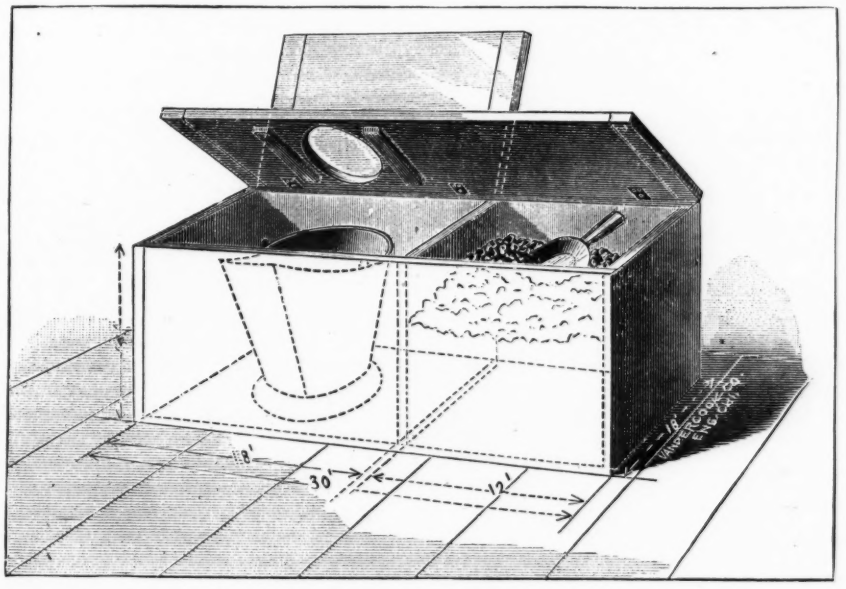
FIG. 11.—PLAN OF PRINCIPAL STORY.
a, Seats. *b*, Chute or Drain. *e*, Vent. *c*, Window. *d*, Small Entrance Hall.

devoted to latrines, a set of four for each story (Figs. 8 and 9). There is a passageway extending from the main building with solid stone balustrade to prevent people from falling. There is a chute or drain from each seat leading to a double arched cesspool. This part of the building is ventilated by a large window above the highest tier of latrines. The castle of Pierrefonds was constructed in the fourteenth century. It has a set of latrines arranged for each story in a semi-circular projection (Figs. 10, 11 and 12.) The cesspool, as we will call the receptacle of the excreta, has a door for cleaning out the filth, and a window for ventilation. In the center of this chamber is a large piece of cut stone on which a man can stand conveniently while cleaning out the pit. The chute or drain leads directly from the seats to the cesspool, and is carried through the roof for the purpose of ventilation; the first instance, probably, of a soil pipe being carried through the roof. These closets (and it was nearly always the case at this period, as we have mentioned before,) were separated from the main building by a short hall with a door at each end. This idea, in some instances, has been utilized in modern times. The closets also have windows and vents in each story.

Earth Closets for Use Where Sewers are not built.

HEN water-closets cannot be made available, the earth-closet will be found of the greatest convenience and benefit. In addition to the well-known dangers attending the neglected accumulation in privy vaults, I know of few things more destructive of health and comfort than dependence upon one of these dreadful outbuildings. A visit to one of them involves an amount of exposure in cold weather which even strong men have reason to dread. In the case of women, children and invalids, I can think of few things worse than a plunge out of doors in cold or stormy weather, usually without the precaution of extra clothing, or overshoes, for a visit to the foul shrine of Cloacina. The neglect of regular attention to the calls of nature, which the dread of this exposure induces, tends to encourage women and children in disregarding them as long as possible until the evils inevitably attendant upon the habit of constipation, much too prevalent in this country, are induced and confirmed. The head of a family who makes no better provision than an out-door privy for the needs of his household, neglects the most obvious, as well as the most selfish of his sanitary duties.

It was a necessity resulting from the temporary occupancy of a country house without "modern conveniences," that led me to experiment with earth-closets, and I am glad of an opportunity to give others similarly situated the benefit of what I have learned. I first consulted the advertisements and bought an apparatus costing about $35. It was a neat bit of cabinet work, highly recommended, but not quite practical. The deodorizing material was contained in a reservoir above and behind the seat, and, after use, the movement of the lever was supposed to discharge into a pail a fixed quantity of this material. Its automatic character was the principal objection to it. Sometimes the material would hang suspended in the reservoir, and had to be jarred down down before the discharging apparatus would work. But the principal difficulty was that it was seldom thrown where it was most needed, and that the dust was inconveniently deposited on the seat. I then set about to make one which should not be automatic, and I have never since been without one or more of this pattern. The accompanying sketch requires but brief explanation: The body is a plain pine box. Its sides are not over 14 inches high; its depth is 18 inches (measuring from front to back), and its length about 30 inches. It is divided into



Earth Closet Construction.

two compartments, one 18x18 inches, and the other 18x12 inches. The larger of these compartments has no bottom; the smaller has a tight bottom. On top I have two covers. The lower cover, hinged to the upper edge of the back, extends all the way across both compartments. In this is cut the seat, of usual pattern, over the center of the larger compartment. The upper cover is hinged to the lower one, and may be raised independently. It is made the size of the larger compartment only—both covers having a little overhang to facilitate lifting them. The material in, and work on, such a box will cost anywhere from $2.00 to $3.00, according to the amount of finish put on by the carpenter.

The receiving vessel is a galvanized iron coal hod, as large as will stand in the larger compartment with the covers down. The smaller compartment is filled with dry earth, ashes, peat dust, or whatever else is used as deodorizer, and a little hand shovel, or scoop, is laid in. The closet is then ready for use, which should be preceded by throwing into the coal hod as much of the dry material as is needed to cover its bottom an inch deep. When used, the upper cover is raised, exposing the seat. After use the lower cover is also raised, uncovering both compartments. A small quantity of the dry material is then taken in the scoop and sprinkled over the contents of the hod. A quart is usually more than sufficient. This operation is repeated, whenever the closet is used, until the hod is full, when, of course, it must be emptied. Its contents will turn out as a solid mass, inoffensive to sight and smell. Even the most fastidious person, with strength enough to carry the full hod out of doors, would make no objection to emptying it. Occasionally, it is well to air and sun the hod after emptying. I have never known one to require other cleansing. It is better not to use an earth closet as a urinal, but so much of such use as is incidental to its employment as a stool in no respect interferes with its satisfactory workings. In my own house I have placed no restrictions whatever upon its use for any purpose for which any one with sense would consider it adapted. The only time I ever had trouble with it was when a new servant, mistaking it for a water-closet, overflowed the hod with the contents of a large chambermaid's pail of wash-water from the bedrooms. I then had some rather unpleasant mud to dispose of.

The best of the materials for use in the earth-closet which can be had, without expense or trouble, is the fine siftings of anthracite coal ashes. Ashes from bituminous coal are not adapted to the purpose. Dry, loamy earth, or leaf-mold, will answer very well, but it is troublesome to dry and store it. It cannot be had dry enough out of doors, even in midsummer. Sand is useless.

Discreetly and decently used, an earth-closet gives very little trouble. If ashes are thrown in after each use, it will not require any attention until the receiving vessel is full. My earth-closet was once, by accident, put to a crucial test. Having occasion to leave home somewhat suddenly, I locked my house and took my family with me. After starting on my journey, I remembered that the earth-closet receiver was nearly full, and that I had forgotten to have it emptied. Speculation as to the condition in which I should find it on my return home caused me no little uneasiness. I could not do anything about it however. After an absence of about three weeks, during the hottest part of the summer, I returned home, to find everything as I had left it and notwithstanding the fact that the earth-closet had been locked up in a close room, not a trace of disagreeable odor could be detected. Whether earth would have done as well as ashes under these circumstances, I am unable to say. The object of leaving the larger compartment bottomless, is to facilitate cleaning. More or less ashes will be spilled around the hod, and this should be swept out frequently. By raising one end of the box, the floor under it can be swept much cleaner than the bottom of a box could be without turning it over.

Such an earth-closet as I have described can be placed and used anywhere indoors. I have no doubt it could be made a nuisance, especially if boys were permitted to saturate the wood with urine, if a person using it should forget to use ashes, or if the hod were left to become overfull and matter intended to be held in it should roll off on the floor. It needs attention like every other good thing, but given as much care as would be bestowed upon any other article of furniture, it meets all the requirements of a safe and convenient indoor commode.

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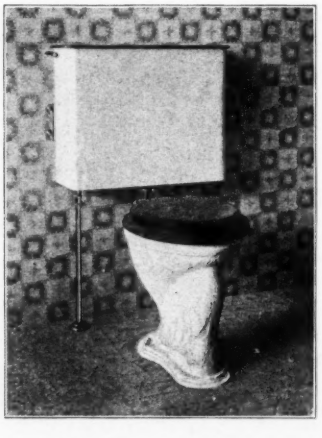


The Electric Fountain.

On page thirty-seven we illustrate an electric fountain installed by an American firm near England's Crystal Palace. Thinking that a detailed description would interest our readers we wrote to the contractors, The Benj. F. Shaw Co., of Wilmington, Del., asking them to enlighten us further. Following is their answer:

Wilmington, Del., Dec. 4, 1900.
Editor Domestic Engineering, Chicago.

Dear Sir:—Your favor relative to the electric fountain erected at the Crystal Palace, London, received. The contract for the piping, fittings, valves, jets, etc., was received by us from Mr. Fredrick Darlington, electrical engineer, of Philadelphia, Pa., the patentee of the fountain. The installation was composed of four and six-inch cast iron flanged pipe and fittings, with wrought iron pipe and fittings of sizes from four to one-eighth inches. In all we made shipment to this contract of about 125,000 pounds of material. We furnished four men of our employ and secured other help on the ground. The contract consumed about six months. The photograph you have shows but part of the entire system, as there are three separate and distinct fountains, one large and two small ones. The diameter of the large basin is one hundred feet, and of the small ones forty feet. There are about 6,000 water jets of various sizes in the three fountains. The large fountain is supplied with pressure from two electric pumps, driven by four dynamos and furnishing about 8,000 gallons per minute. The two smaller fountains are supplied from water towers located on the grounds. The system on which the fountains are operated is as follows:

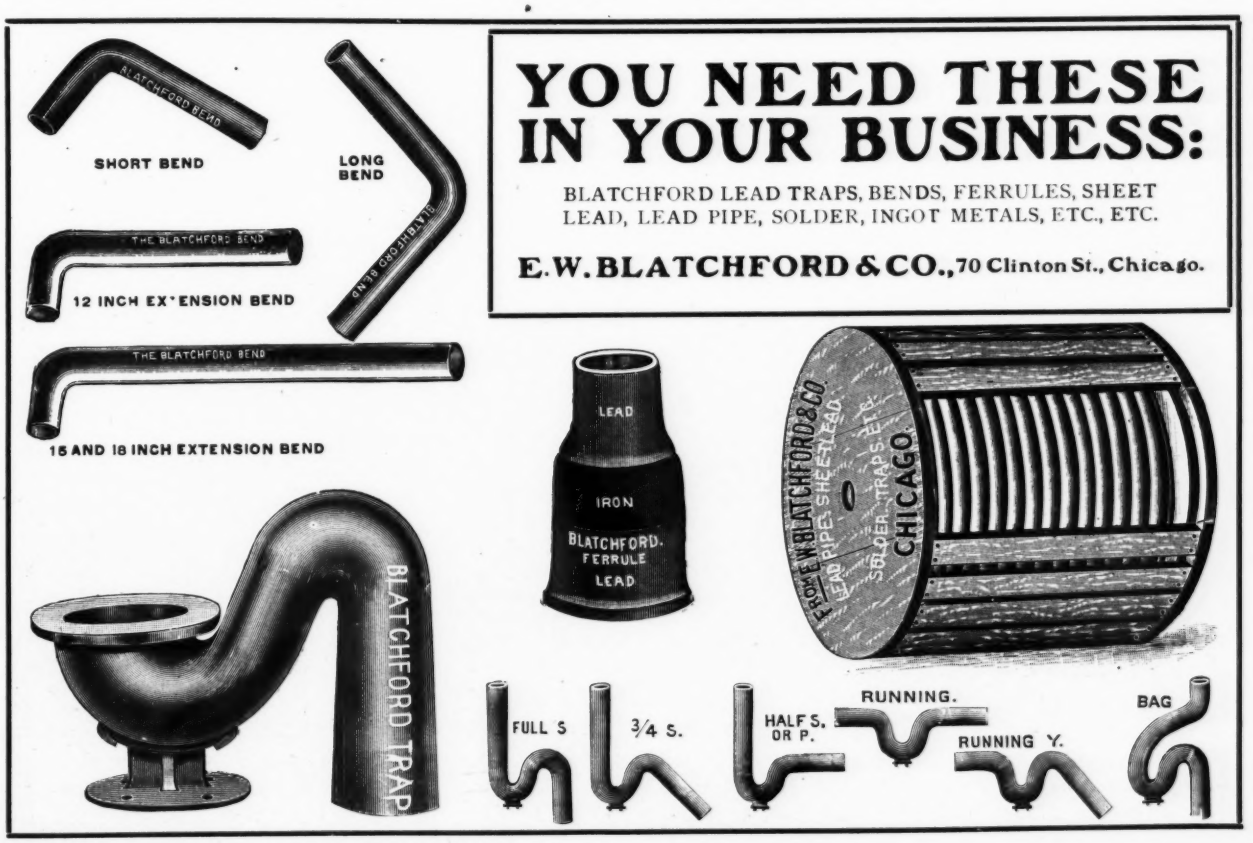
A water tight basin is furnished made up of structural and corrugated iron, brick and cement, on the floor of which the various lines of piping are arranged. The basin is supported by iron piers about ten feet high and the excavation or cellar is utilized for the light and color apparatus as well as the electrical pumping machinery.

On the photo you will notice iron cylinders or funnels placed in an upright position. These funnels are topped with plate glass 1½ inches thick. Beneath each of these funnels is located an arc light and reflector. Around the funnel is a series of pipes containing the water jets, so arranged as to form different designs such as wheat sheaves, fans, etc. Between the base of each funnel and are light is placed a series of various colored glass frames, said frames being brought into and out of position by means of an air system. The water to any system of pipes is controlled by lever valves worked by an operator. For instance, the valves controlling the water to the outer line of funnels being opened, giving a certain display, the operator in charge of the color scheme by the use of the air system causes a colored disc to operate between the arc light and the funnel, thereby throwing that color up through the glass plate in the top of the funnel and there giving various colors to the water passing near or over the funnel. The fountains are arranged for both day and night displays. There is a reservoir used in connection with the fountain so that the water can be used continually.

We have installed, besides the above, fountains in Willow Grove, Pa.; Brooklyn, N. Y.; Huntington, Long Island; and Baltimore, Md. They are being adopted by many electric railway companies as attractions in their parks.

We would be pleased to furnish printed matter on the subject showing the various designs of fountains and the displays of same. Very truly yours,

Benjamin F. Shaw Co.,
Townsend W. Miller, Sec.



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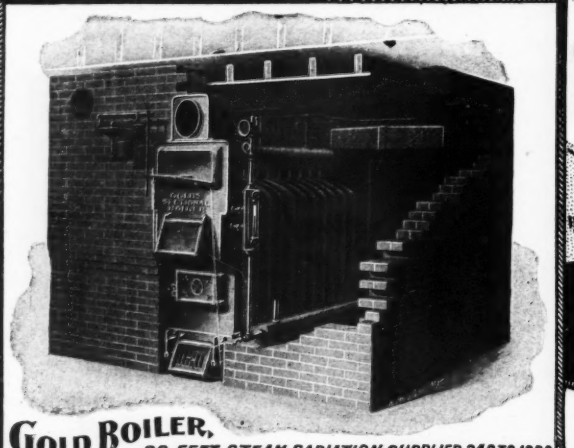

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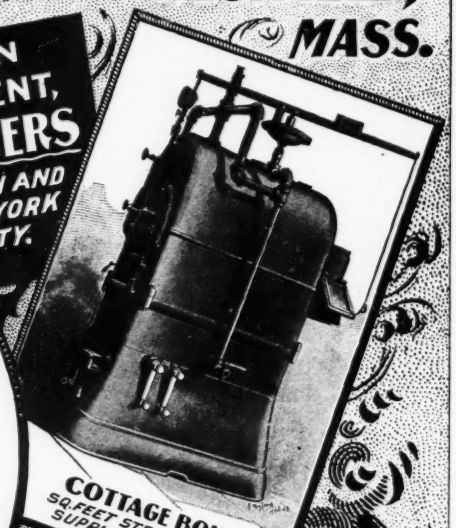

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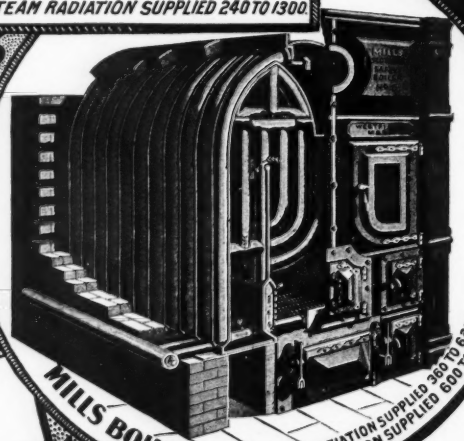

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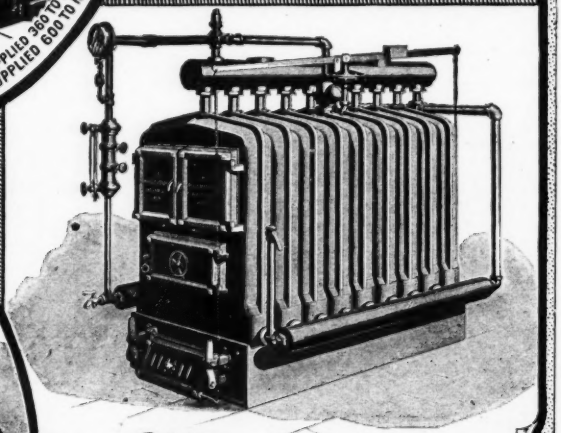

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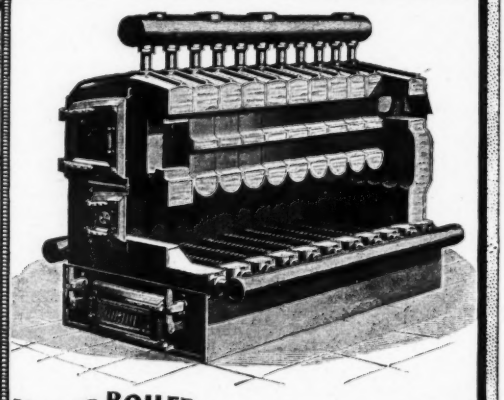

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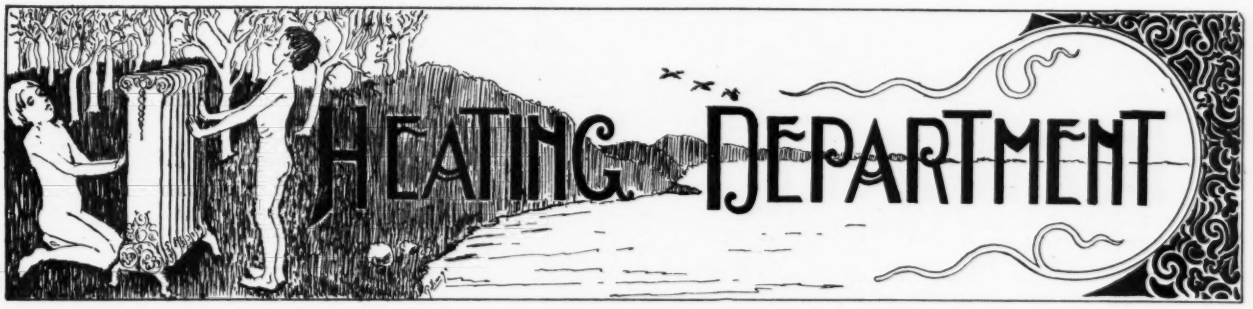


Methods of Testing Blowing Fans.

Read by Prof. R. C. Carpenter of Cornell University, before the American Society of Heating and Ventilating Engineers.

THE following paper is a supplement to the one presented to the society at its last annual meeting, and is intended to call attention to certain difficulties experienced in the testing of blowers, with the expectation that the discussion will give valuable suggestion and possibly lead to the adoption of standard methods.

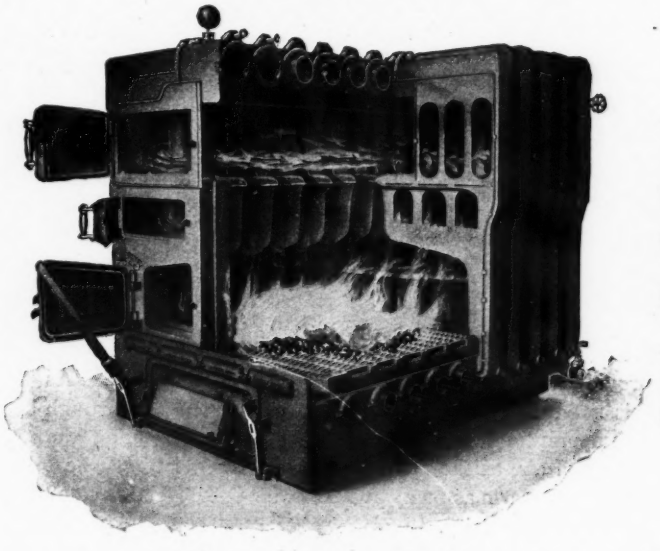
Object of Test.—The object of the test made on a blowing fan is, in nearly every case, the determination of the capacity of the fan either to move a given volume of air or to produce a certain pressure, or the determination of both of these qualities; also the determination of the power required for moving a given quantity of air under a certain pressure; and, finally, the efficiency of the fan. From complete tests as outlined above can be determined the economic value of different forms, and usually the costs of moving certain quantities of air under given conditions.

It is necessary to meet these requirements, to make accurate measurements of, first, the power required to operate the fan; second, the volume and weight of air delivered by the fan; third, the pressure produced by the fan; fourth, the work performed and the efficiency.

Referring to these various requirements, it will be found that the measurement of the volume of air is the one most difficult to obtain with any degree of accuracy.

The measurement of the power required to operate the

"Capitol Heaters"



The adjoining is an illustration of the "98 Series Capitol," the popular heavy-duty boiler of the day. An investigation would undoubtedly prove of interest to any in the trade not already familiar with this construction. Descriptive catalogue mailed on application.

United States Heater Company

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fan can generally be made with accuracy, although the method used will depend upon the character of the power. If the fan is driven by a steam engine, the total power can be obtained from indicator diagrams with an error perhaps less than 2 per cent. The indicator shows, however, not the power applied to the fan, but the power applied to the piston of the engine, and this must be corrected by deducting the power consumed in engine friction. The latter may be obtained accurately from indicator diagrams taken when operating the engine and belt, without moving the fan, at various speeds. More accurate measurements of the power may be obtained by use of a transmission dynamometer which is directly connected to the fan, and which is driven by an engine and arranged so as to show the transmitted power. In the various tests on fans which have been described to the society by the author in the past, both methods of measurements of power have been used, and comparisons have been made which show that the results are

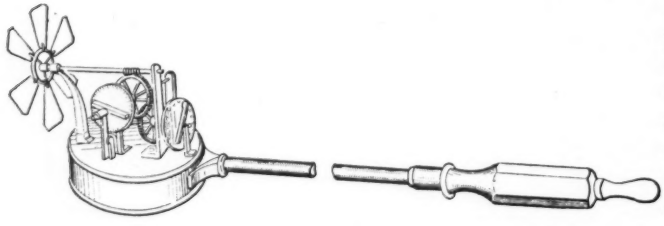

Fig. 1

essentially the same by either method. In the tests which will be described in the following paper, the power was measured by an Emerson power scale, which was mounted on the same axis as the fan. The mechanism as arranged in this way gave accurate and satisfactory results.

The volume and weight of air delivered by the fan is almost invariably obtained by measuring the velocity of the air, and from this computing the volume and weight. With the average velocity known, the volume is readily computed by multiplying the velocity by the area of cross section through which the air flows. The weight is computed by multiplying the volume or number of cubic feet by the weight per cubic foot, which is to be obtained from tables prepared for such uses.* The measurements of velocity of the air are usually made with the anemometer or the Pitot tube.

The anemometer was probably first used by Woltmann or Kallsténius as early as 1820. It consists of a very delicately constructed vane wheel, so mounted as to be revolved by the air. A counter and graduated scale gives the velocity of the air striking the vanes usually in feet per minute. The anemometer is provided with detent motion, so that the register can be stopped or started at the will of the operator. A form of the anemometer designed by M. Morin, as shown by Peclet in his work on "Heating and Ventilation," is shown in Fig. 1 as used about 1840; this form is interesting as showing that but little improvement has been made in this instrument during the last generation.

It was shown by M. Combes in 1838 that if n be the number of turns of the vane wheel of the anemometer, and a and b constants, that the velocity of the air would be expressed by a formula

$$v=a+bn;$$

this would signify that a constant to be determined by experiment must be added to the anemometer readings. Such constants are usually given with every instrument by the makers, and are supposed to be determined by calibration.

The anemometer is a delicate instrument, and its continued use is liable to increase the friction of its working parts and cause variation in the constants a and b; for this reason it should be calibrated from time to time. The method usually prescribed for calibrating an anemometer is to fix it to a revolving arm of considerable length and swing it through still air a known number of revolutions corresponding to a certain distance of travel. The error of the instrument is determined by comparing the reading of the instrument with the distance passed through by the anemometer. Another method of calibration is by comparing the reading of the anemometer with air moving at a known velocity. The velocity of air moving through a duct of a given cross section can be computed by measuring the amount of heat required to warm the air through a certain number of degrees. This may be done as illustrated in the diagram Fig. 2. A duct A, B, C, D, is supplied with air by means of a blower located in some convenient position. A heater is placed in one end of this duct as at B, the anemometer to be tested is placed beyond the heater at some point N and arranged so that successive readings may be taken at all portions of the cross section; the stopping and starting mechanism is arranged so as to be operated from the outside of the box. One or more thermometers are located at T T', thus permitting the measurement of the difference in temperature of the air. Dry steam is supplied the heater at F, and the water of condensation is drawn off at E, being maintained at a constant level by aid of the gauge-glass g. Every pound of steam at known pressure and quality contains an amount of heat which is

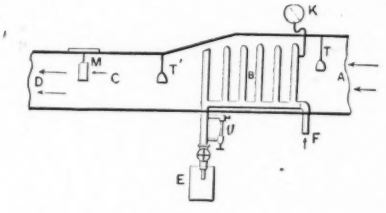

Fig. 2

accurately obtained from the steam table, so that means are provided for computing the heat units given off. As this must all have been used in warming the air through a temperature T'—T, we have means of computing the weight of air; as the specific heat of air is 0.238, one heat unit would warm as many pounds of air one degree as 0.238 is contained in unity.

Let H equal the total number of heat units given off by the steam, R the radiation or loss of heat units between the position of the thermometers—this is usually very small, but can in any case be determined by cooling experiments—T and T' the temperatures before and after

*See appendix work on "Heating and Ventilating."

passing the heater, W the total weight of air in pounds, Q the total volume of air in cubic feet, A the total cross section of the duct in square feet at the position of the anemometer, and C the number of cubic feet of air per pound for the given pressure as determined by tables. For the reasons already stated we have

$$W=\frac{H-R}{.238\,(T-T_1)}$$

$$Q=C\times W;$$

from this we have the velocity

$$v=\frac{Q}{A}=\frac{CW}{A}=\frac{C}{A}\,\frac{(H-R)}{0.238(T_1-T)}.$$

By comparing the velocity of the air as computed in this manner with the average reading of the anemometer, the error may be determined.

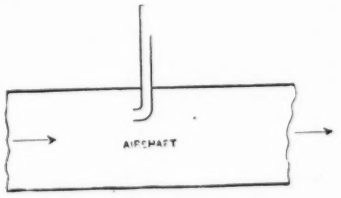

FIG 3.

The errors of anemometers can also be obtained by direct comparison with instruments having known errors.

The velocity of air flowing through a duct of given size may also be determined by the use of large measuring tanks which are alternately filled and discharged with air in such a manner as to give accurately the volume of air flowing. We have recently arranged in Sibley College two large tanks, each holding about 300 cubic feet, for the purpose of accurately measuring the volume of air discharged. Up to the present time this plan has not been used to calibrate anemometers, although it is capable of such use.

The Pitot Tube.—The Pitot tube for measuring air velocity is made by connecting a delicate manometer to a tube bent in such a manner that the opening can be made to face the current of flowing air. By comparing the readings of a manometer connected in this manner with a manometer connected so that the mouthpiece is at right angles to the current of flowing air, a difference in readings will be noticed, which is caused by the velocity of the flowing current. The reading of the Pitot tube in excess of the static pressure is produced by the velocity of air, and is proportional to h in the formula

$$v=k\sqrt{gh},$$

in which v is the velocity of the air in feet per second, and h is the head which is counterbalanced by the force causing the velocity, and may be measured in various units as inches of water, ounces of pressure, feet of water, etc.

If measured in inches of water, which is probably the most convenient measure, the theoretical value when k=1 becomes

$$v=46.8\sqrt{h}.$$

A series of experiments gave as a practical result

$$v=70\sqrt{h},$$

corresponding to a value of k=1.47*; when air is at a temperature of 120 degrees, $v=66.7\sqrt{h}$, corresponding to a value of $k=\sqrt{2}$ when air is at a temperture of 60 degrees Fahr. For air at other temperatures this result must be multiplied by the following factors:

Temp. Air. Deg. F.	Factor.	Temp. Air. Deg. F.	Factor.
32	0.92	100	0.985
60	0.95	120	1.00
80	0.965	150	1.05

By connecting one side of the manometer to a Pitot tube and the other side to a plain tube the manometer may be made to show the difference of pressure due to the velocity of the air by a single reading and without subtraction. A form of Pitot tube, with a very delicate reading manometer, as supplied by Schaffer & Budenberg, of Brooklyn, N. Y., and as designed by the writer, is shown in Fig. 4 in position in a pipe.

The diagram Fig. 5 represents a graphical method of obtaining, without labor, the velocity of air from readings of the Pitot tube. The diagram, as arranged, has readings of Pitot tube horizontally at the bottom, while corresponding velocity results are to be read on four scales located two on each side. For instance, if the manometer reading is between 1 and 10 inches, the readings will be taken opposite the lower diagonal line on the left-hand scale; thus, if the Pitot tube reading is 2.5 inches, we note the intersection above 2.5 with the first diagonal line, the velocity read on the left scale is, by interpolation, 108. If, on the other hand, the reading of the manometer is 2.5 tenths or 0.25 inch, the velocity would be read opposite the upper diagonal line on the right-hand scale, and would correspond to 35.7 feet per second. If the manometer reads 2.5 hundredths of one inch, the velocity would be found by

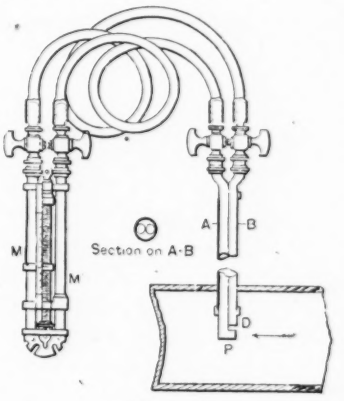

FIG. 4.

noting the intersection of the vertical through 2.5, with the lower diagonal using the scale on the right, which gives us, by interpolation, 10.8 feet per second. If, on the other hand, the reading was 2.5 thousandths, the velocity would

*It should be noted that h is greater in relation to v as the value of k is less.

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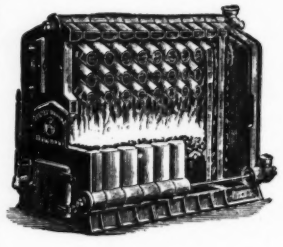

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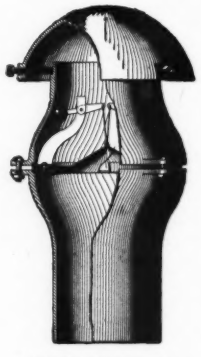

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be found by noting the intersection above 2.5 with the upper diagonal, the velocity being given by the scale at the left as 3.57 feet per second. In practice it will be found that quite accurate measurements of the velocity may be obtained for the higher manometer readings, but that considerable percentage error will be likely to result in obtaining the velocity from the low manometer readings, due principally to the difficulty of making accurate readings of low manometer values. The Pitot tube is, consequently, well adapted for measuring high velocities of air and, with a sufficiently delicate manometer, it will give good results in measuring moderately low velocities.

It is not, however, as well adapted for low velocities as the anemometer, nor can it be used as conveniently.

It will be noted that the Pitot tube will give the velocity at a position of limited area, and hence with this instrument it is possible to obtain the velocity at any given point in the cross section of a flue and at some distance from the manometer.

The writer has tried in connection with the Pitot tube several forms of multiplying manometers, but has not obtained as satisfactory a result as with a close reading direct manometer which is provided with a micrometer for giving the decimal portions of an inch. In most of the multiplying manometers the vibration of the water column effects the reading to such an extent as to counterbalance the advantages due to the system of multiplication employed. Several forms of manometers are described in the description of apparatus used for measuring pressure which follows.

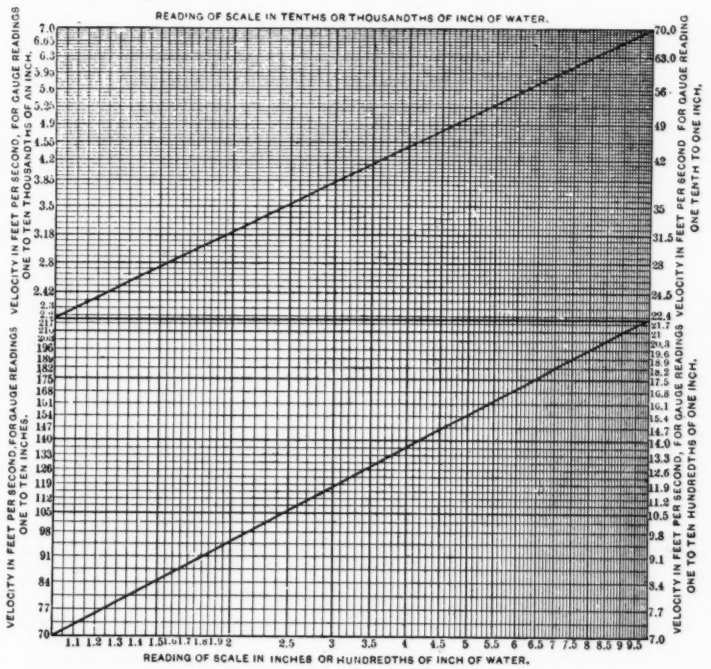
READING OF SCALE IN TENTHS OR THOUSANDTHS OF INCH OF WATER.
VELOCITY IN FEET PER SECOND, FOR GAUGE READINGS ONE TO TEN INCHES.
VELOCITY IN FEET PER SECOND, FOR GAUGE READING ONE TENTH TO ONE INCH, ONE TO TEN HUNDREDTHS OF ONE INCH.
READING OF SCALE IN INCHES OR HUNDREDTHS OF INCH OF WATER.

FIG. 5.

In 1884, the Prussian Mining Commission investigated, by means of a large gas-holder which contained over 70,000 cubic feet, the following questions relating to the measurement of the velocity of air:

(1) Do the formulæ generally used for standardizing anemometers in a circular path in still air give correct results or not?

(2) Can the Pitot tube be applied practically for measuring the speeds of air, and, if so, what formula should be used for calculating the speed and quantity of air?

DESCRIPTION.

The accompanying cut is half size. The form of the Draught Gauge is U shaped and consists of the following parts: The U glass tube *B D*, air cock *C* for hose connection, cup *A*, guides *G* and *F*, vertical scale *I* which is divided into inch, half, quarter and one-twentieth of an inch, screw *K* for adjusting index pointer *O*, and having twenty threads to the inch; the index wheel is divided into twenty-five parts, the whole combination is raised and lowered by screw *E*; *S* serves as a protection for glass tube and bearing for *E*.

Since the screw *K* has twenty threads to an inch, and the scale is divided in $\frac{1}{20}$ of one inch, then for one turn of *K* it moves index *O* one division, and since the index wheel has twenty-five divisions, each division is then equal to $\frac{1}{25}$ of $\frac{1}{20} = \frac{1}{500} = .002$. For example, if second division to the right of zero on the index wheel were placed on *R*, it would then be read $1 + \frac{1}{20} + \frac{1}{500} \times 2 = 1 + 0.1 + .004 = 1.104$; *i. e.* each small division on scale *I* is equal to .05, and on index wheel equal to .002.

The instrument is nickle plated and enclosed in a handsome morocco case.

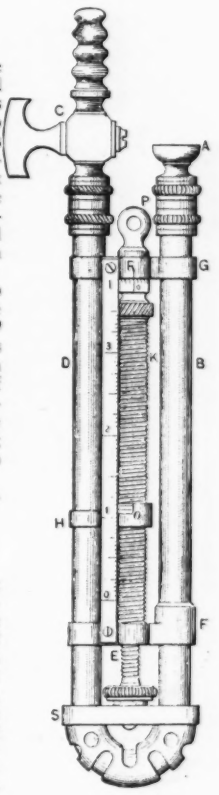

FIG. 6.

METHOD OF OPERATION.

The glass tube is filled with water to about one-third its height, one end of a flexible rubber tube is then connected to cock *C*, and the other end is inserted into the chimney flue. *B* is then open to the atmosphere and *D* is in communication with chimney flue. There will now be a difference of water level in tubes *B D*. Adjust *m* so than it will be tangent to bottom of meniscus by screw *E*, snd *n* by means of screw *K*. If it is desirable, cock *C* can be closed and the difference of water level maintained and taken to some convenient place to read.

(3) May the fall in pressure between one side and the other of a thin orifice interposed in a pipe, be used to determine its velocity, and, if so, what formula should be applied?

(4) What is the loss of head due to friction caused by the length and diameter of pipe used?

(1) The results of this inquiry were briefly as follows: first, that anemometers calibrated by swinging in still air show errors which range between 7 and 13 per cent, the anemometers always reading high.

(2) A Pitot tube may be used with accuracy for measuring the velocity of air, the formula being as follows: velocity of air in meters per second at zero centigrade

$$= 4.265\sqrt{\frac{\text{pressure in mm. head of water}}{\text{density of air}}}.$$

This recuced to the average temperature and density of the air becomes $4\sqrt{h}$, h being the head in millimeters of water.

(3) The fall in pressure between one side and the other of a thin orifice may be used. If H is the difference in pressure represented by feet of air, the formula for flow would be

$$Q = CA\sqrt{gH},$$

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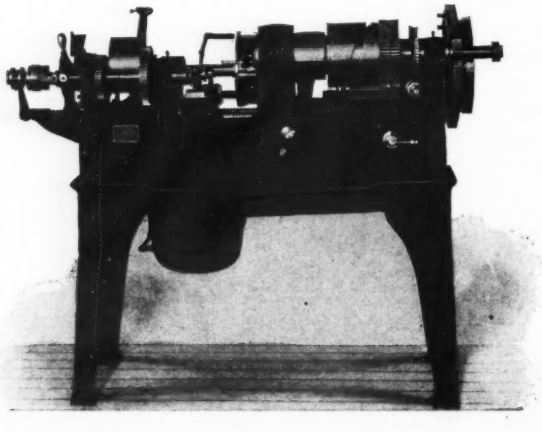
in which A is the area and C a coefficient which equals 0.64 for circular orifices and 0.61 for square orifices.

(4) The loss in head due to friction as obtained in a cast-iron pipe 14.3 inches in diameter, was found to vary as the diameter of the pipe affected with the exponent 1.32, as the square of the velocity and as the density affected with the exponent $\frac{2}{3}$.

The general results of the tests show that the anemometer gives an exaggerated value of the air discharged by a fan, especially when standardized by rotating in still air. In computing the volume of air delivered, the error in the result would be directly proportional to the error of the anemometer, which, as shown by the previous tests, averages not far from 10 per cent high. The error in work performed and in efficiency, however, would vary as the cube of velocity and, consequently, as the cube of the error in the anemometer. If the anemometer error be 10 per cent, the error in work done and in efficiency would be 33 per cent.

Measurements of Pressure.—The difference in pressure produced by a blowing fan is usually very small as compared with the total barometric pressure, and is ordinarily measured by some delicate gauge. The simplest apparatus and the one most commonly used is a U-shaped tube filled



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with some liquid such as water. One side of this tube is put in connection with the vessel subjected to the pressure to be measured; the other is connected with the atmosphere, or, as explained in the discussion on the Pitot

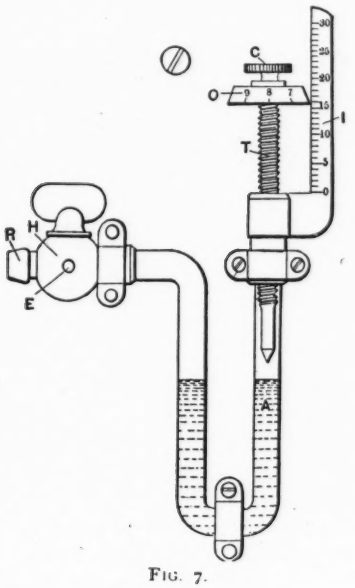


FIG. 7.

tube, in such a manner that the difference of any two pressures may be read directly.

The delicacy of the instrument will depend upon the weight of the liquid used; the heavier the liquid the less delicate is the instrument.

For the measurement of air pressures, water is ordinarily employed, and the results obtained are expressed directly in inches of water or are reduced to ounces or pounds per square inch. By locating the U-shaped manometer in such a position that the eye can sight over the under surface of the liquid in the tube, a very delicate reading may be determined by aid of the total reflection of light as seen from the meniscus at the top of the column of liquid. An elevation considerably less than one-hundredth of an inch can thus be determined with accuracy. By arranging a point back of the last tube and one in front and noting the position of the bottom of the meniscus, very delicate

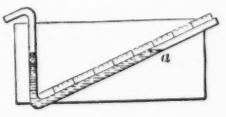


FIG. 8.

changes can be read. The writer has designed a direct reading manometer of this type which is manufactured by Schaffer & Budenberg, which is arranged to read to thousandths of an inch by means of an attached scale and micrometer screw. The zero of the instrument is adjustable so that a single reading gives the difference of level. The form of this instrument is shown in Fig. 6.

Another form of direct reading manometer, as designed by Professor Kinealy, is shown in Fig. 7, in which the level of the water is shown by contact of a sharp-pointed screw; the level of the surface being determined by the readings of a manometer screw on an attached scale, two readings being necessary to determine the difference of level.

Several forms of indirect gauges, by means of which the readings are multiplied, have been designed. One of the simplest forms consists in the use of an inclined tube for one of the legs of the U-shaped manometer. This arrangement permits the use of a longer scale, which is subdivided in such a manner as to give small fractions of an inch, and is shown in Fig. 8.

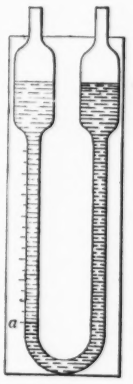


FIG. 9.

Another form consists in the use of a U-shaped tube connecting with the large bulbs at each end (Fig. 9), in which two liquids of different color and of slightly different

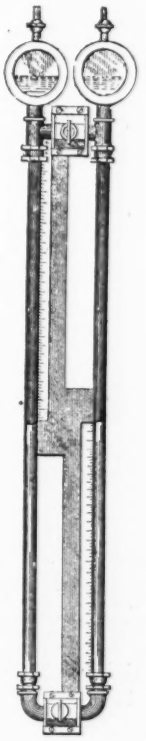


FIG. 10.

density are used. The line of junction (a) of the two liquids being in a small tube, will move a much greater distance than the surface of either, and this is utilized for multiplying the readings. This is an excellent gauge, but the value

of the readings should be determined by trial. Kerosene and colored water make good liquids for use.

A modification of this gauge, as designed by J. C. Hoadley, was described in Vol. II, Transactions, and is represented in Fig. 10.

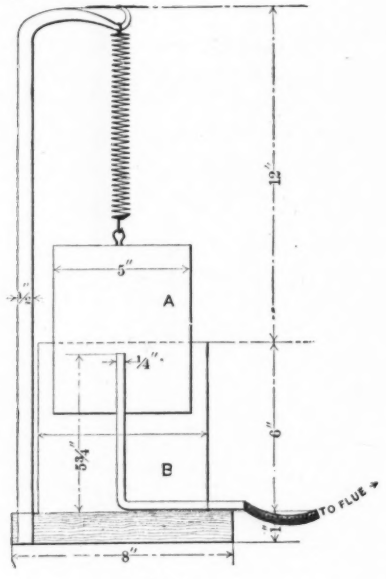


FIG. 11.

Mr. Kent described before the Society in Vol. III, Transactions, a very excellent form of multiplying draught-gauge, which is shown in Fig. 11; this we have used with success. A pipe leading to the pressure to be measured is connected under the vessel A, which is suspended by a delicate spring over the vessel B, which is partly full of water. The amount of motion for a given difference of pressure is dependent upon the strength of the spring and the area of the top of the vessel A, and its value should be determined by calibration; it can then be subdivided as desired.

A form of multiplying manometer, shown in Péclet's Traite de la Chaleur, is represented in Fig. 12. It consists of an air-tight box partly filled with water, the upper portion of which is connected with the chimney or vessel under pressure. The pressure is measured by a float connected to a revolving axis on which a pointer is attached; the float, moving in a well which is subjected to atmospheric pressure from above, will change its position dependent upon the pressure in the chamber A. The graduated scale serves to show the draught. The instrument is to be calibrated by an attached manometer M. This instrument might be a very valuable one for use under conditions where it would not need to be moved. Its form is not well adapted for moving around.

Péclet shows several forms of manometers in his work, many of which have been reinvented since his time and now pose as novel constructions. The ones of principal value are those which have been described.

The Work of the Fan.—The work performed by the fan is made up of the resistance due to moving and compressing a definite amount of air. It can all be considered as equivalent to moving a given weight of air through a height or head which is equivalent to the sum of the velocity and pressure heads expressed in feet of air at the density corresponding to the air after being compressed. These results can be expressed in the shape of a formula. Thus let Q equal the volume of the air at atmospheric pressure, Q′ its volume at delivery pressure, c′ the weight per cubic foot at atmospheric pressure, c′ the weight at delivery pressure, W′ weight of air delivered per second, d density at atmospheric pressure, and d′ at the delivery pressure, v the velocity, A area of cross section at point of measurement of velocity, and M work in foot pounds per second; then we shall have

$$Q = vA = Q\frac{dv}{d'}A,$$

$$W = Q'c' = Q\frac{d}{d'}c\frac{d'}{d} = Qc,$$

$$M = \text{work} = Wh' = Wh\frac{d}{d'} = Qch\frac{d}{d'};$$

in which h equals the sum of pressure head and velocity head as measured at the same point expressed in feet of air at atmospheric pressure, and h′ the same quantity expressed in feet of air at delivery pressure.

In the testing of the fan it will be found that the pressure head, as measured from the manometer, will be smallest, as a usual thing, when the velocity head, as measured from a Pitot tube, is highest, and vice versa. Hence it is essential to measure these two quantities at the same point.

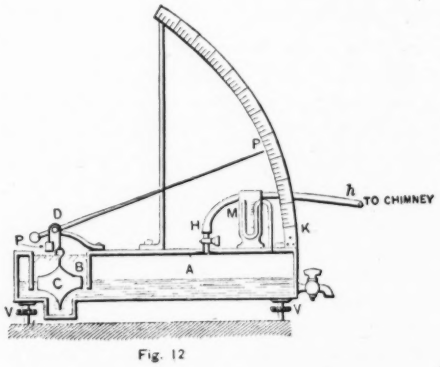


Fig. 12

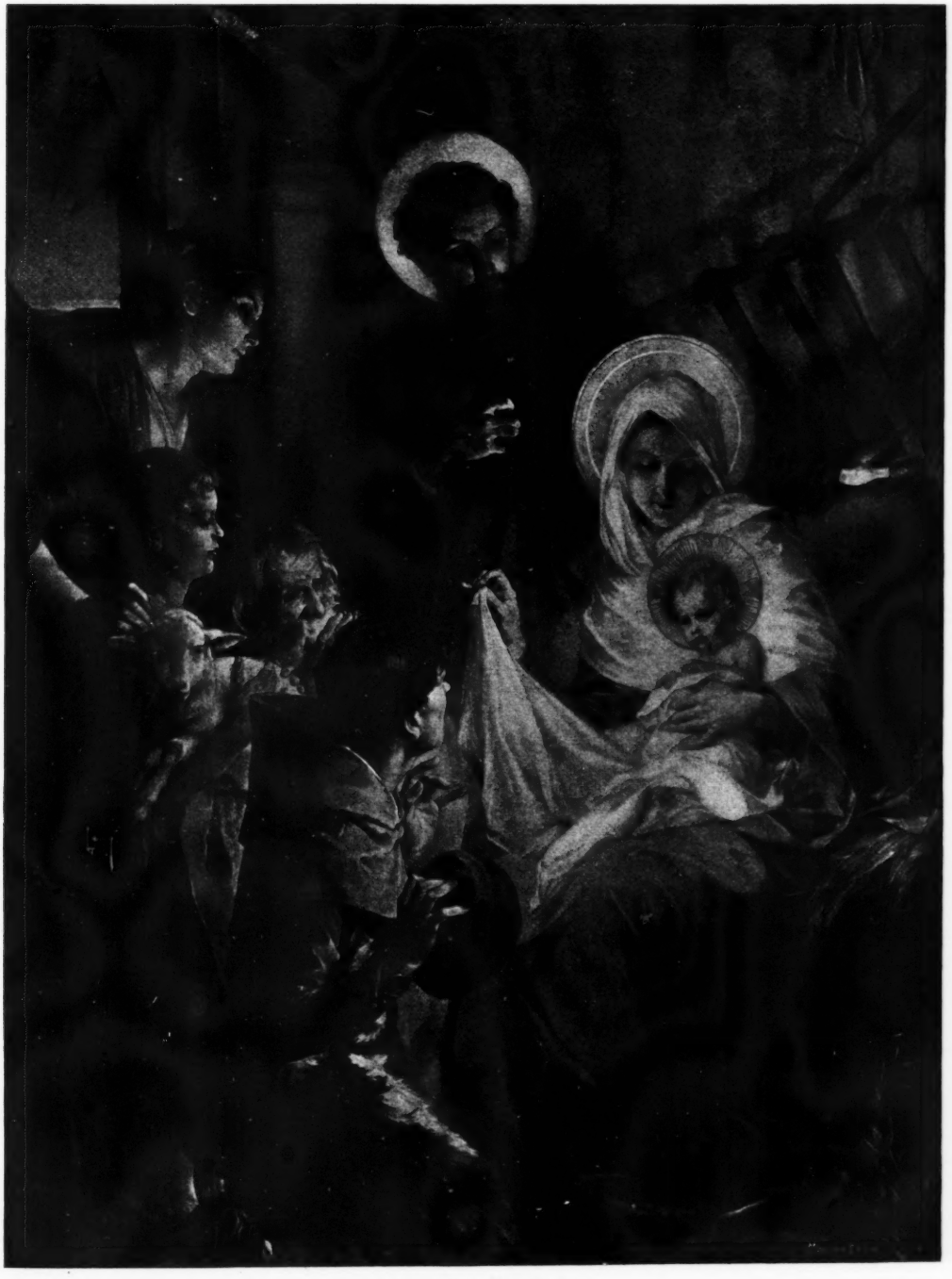
In case the velocity head cannot be directly measured by use of a Pitot tube, but instead of that the velocity is measured, the corresponding velocity head may be computed from the formula

$$h = \frac{V^2}{2g},$$

which is quite accurate for air of 60 degrees temperature, but would be subject to correction for other temperatures, which may be deduced from the table previously given.

Efficiency.—The efficiency of a fan is to be found by dividing the work supplied by that usefully applied in moving the air, and computed as explained.

Notes Regarding Testing of Fans.—It will be found in the actual operation of testing fans that the air delivered moves in irregular currents, and, consequently, in order to obtain average results, readings must be taken in all portions of a given cross section. In order to obtain the



THE HOLY NIGHT.

This plate is a sample of half-tone engraving
by J. Manz Engraving Co., of Chicago, Ill.

average readings, the cross section should be subdivided into a number of small sections of equal area, and the velocity in each one of these smaller subdivisions should be obtained by the method described.

In case the subdivisions are not of equal area, an allowance should be made in determining the average for those subdivisions which are larger, by multiplying the readings by factors giving the relative proportion of area.

As a rule, the pressure and velocity readings of the fan should only be taken after the air has travelled some distance, in order that the inequalities spoken of may be lessened as much as possible.

The use of baffle-plates to equalize the velocities and pressures is likely to add considerable friction head to the fan, and are not recommended.

Many of the tests which have been recorded of fans show an abnormal and sometimes an impossible efficiency. This is usually due to errors in the anemometer used, which make practically about three times as much difference in the efficiency as in the volume of air delivered, due to the fact that the error in volume would vary as the error of the anemometer, whereas the error in efficiency and in work performed would vary as the cube of this error.

There are certain losses which necessarily take place in the fan when constructed in the most perfect form, which are due to the striking of the particles of air against the vanes, to adverse air currents at the point of discharge from the vanes, and to friction against the casing. It is considered by some authorities that the unavoidable losses will reach from 25 to 33 per cent of the power supplied the fan, and hence the limit of possible fan construction will result in an efficiency of from 66 to 75 per cent. The efficiency of a fan varies with the pressure against which it works, the highest efficiency being usually found in our experiments when the fan is working under a back pressure of approximately one ounce. Working under the condition of highest efficiency, the fan discharges the greatest weight of air per horse-power, but not necessarily the greatest volume, unless the volume be measured at atmospheric pressure.

It will also be found that the form of the fan blades has considerable effect on the results. In my experiments with different forms of blades at a given speed, the highest pressures have resulted when the fan blades were bent forward and the highest efficiency when the fan blades were bent backward.

The general results of my experiments would indicate that a fan efficiency of from 40 to 50 per cent is as high as can be expected with the best construction working under usual conditions, and, furthermore, that any published efficiency which is greater than 50 per cent is to be regarded with considerable suspicion.

Form of Blank for Recording the Results of Blower Tests.—In connection with test of blowers in Sibley College, Cornell University, we have arranged the following form to tabulate the average results of the tests. The blank is presented for criticism and also in the hope that it may be useful for the purposes for which it was designed.

DEPARTMENT OF EXPERIMENTAL ENGINEERING, SIBLEY COLLEGE, CORNELL UNIVERSITY.

TEST OF BLOWER.

Kind	Date.....
Form of Blades.....	Discharge Area.....
Diameter of Fan.....	Temp. of Room .....
Width of Fan.....	Barometer .....
Form of Inlet.....	Anemometer Diam.....
Inlet Area.....	" Coefficient.....
Formula.	Weight of Air per Cu. Ft.....
Made by.....	.....

No. of Run.	I.	II.	III.	IV.	V.	VI.
Time begun.....						
Time ended						
Length of run.....						
Duration in minutes.....						
Tachometer						
R. P. M. of Fan						
Air pressure per sq. in., ounces. Avg.						
Pressure head in water, inches, "						
Velocity " " " "						
Anemometer readings. "						
Velocity of air, feet per second. "						
Cubic feet discharged per second.....						
Weight of air discharged per second..						
Velocity of fan blade tips ft. per sec..						
Dynamometer reading.....						
" horse power.....						
Developed horse power.....						
Cubic feet air per H. P. per second...						
Efficiency, per cent.....						
.....						
.....						
.....						
.....						

The Machine Trades and Professions Association.

APROPOS of the efforts being made in Chicago to found a union whose basic principle shall be arbitration, it may be of interest to our readers to learn that the metal workers of Columbus, Ohio, have a strongly organized and growing industrial association which is pledged to refer all differences which may arise with employers to a board of arbitration composed of delegates from the employers' and employee's associations. The union is incorporated under the laws of Ohio as the Machine Trades and Professions Association, and is receiving the commendation of all who have learned of its workings and approve of efforts to make strikes, lockouts and boycotts a thing of the past.

In a circular letter to the members of the National Founders' Association, Mr. Robert H. Jeffrey, of the Jeffrey Manufacturing Company, strongly recommends the movement as founded upon a rational basis and calculated to control warring industrial factions, and urges the Founders' Association to give it official recognition at the annual meeting which is being held in New York this week.

He calls attention to a unique feature of the work of the employees' association, viz., the social and educational advantages which they are able to enjoy with the money once deemed necessary as a strike fund. The admission to honorary membership of engineers, chemists and draughtsmen gives these men an interest in the Association, and they respond readily to invitations to address the mechanical laborers on the scientific aspects of their trade. Employers meet and mingle with their men, and thus good feeling and mutual understanding take the place of suspicion and distrust. Social problems are considered, and many perplexing questions are discussed in a spirit of friendliness with trades unionists, politicians, professional men and bankers, who are invited to address the meetings and lead the discussions.

Departments for co-operative saving, financial benefits and care when sickness or death assail the home have been formed, and outing clubs, athletic clubs and classes for concerts and entertainments organized. Evening classes and lectures are part of the educational work, and it is designed to make the club rooms a place of rational amusement and convenience for workingmen. All these aims are in keeping with the Association's motto: Social, Moral and Intellectual Advancement."

We cannot better illustrate the high ground taken by the Machine Trades and Professions Association or commend it more highly than by quoting in part from its constitution and rules of order:

Preamble.—We, a representative body of mechanics engaged in the several trades necessary for the construction of machinery, in order to better qualify ourselves to promote the trades and professions connected with mechanical construction, and believing that upon the success of the employer depends the steady employment of the efficient employee, shall endeavor to use all honorable means to the success of both employer and employee, and for the social, moral and intellectual advancement of mechanics, we do adopt the following constitution and rules.

Constitution.—Article 1. The name of this organization shall be the Machine Trades and Professions AsAssociation.

Art. 3. No member shall take part in any strike or boycott, except in a proper manner, to defend himself against any such; neither shall any person be admitted to membership who belongs to any organization which in any manner countenances strikes or boycotts.

Art. 4. The objects of this Association shall be to hold meetings for social intercourse and instruction, and the reading and discussion of professional papers, to circulate by means of publication among the members, information thus obtained; and to provide ways and means whereby members, by availing themselves of the advantages offered, may acquire proficiency, which together with moral principles, comprise the essential qualifications required in the highest standard mechanic.

Art. 5. As supply and demand, together with quality, govern remuneration, the question of manner of service and recompense shall be considered a private individual privilege of adjustment. But all questions not so adjusted may be referred to the officers of this Association for arbitration.

Art. 6. This Association shall not be used, in any manner, to further the interests of politics, except in so far as to encourage the enactment of laws for the benefit or protection of its members; nor shall it be used for religious purposes.

Chloro-Naptholeum.

The West Disinfecting Co., of 26 East Fifty-ninth street, are manufacturers of disinfecting appliances to suit all conditions. Chloro-Naptholeum, a non-poisonous substitute for carbolic acid, is their specialty. Their sales during the year 1899 amounted to 150,000 gallons of the preparation. This would seem to justify their claim to be the largest manufacturers of disinfectants. They are constantly putting out printed matter calculated to educate the people on the necessiy of using disinfectants and are always ready to answer inquiries on the subject.

The Century's Achievements.

IT is a convenient system we have of dividing time into centuries. Just as the beginning of a new year is a time for taking stock of past achievements, present conditions and future prospects, so the beginning of a new century is a convenient period for retrospection and prophecy. In an article recently published by Professor A. E. Dolbear, of Tufts college, the achievements of our century are told in a manner which is at once scholarly, comprehensive, and intensely interesting. We regret that we cannot reprint the whole article, but think the following tabulation of results too good not to be passed on to our readers. Speaking of the conditions that obtained at the beginning of the century as compared with conditions of to-day, he says:

We received the horse and ox; we bequeath the locomotive, the automobile and the bicycle.

We received the goose quill; we bequeath the fountain pen and typewriter.

We received the scythe; we bequeath the mowing machine.

We received the sickle; we bequeath the harvester.

We received the sewing and knitting needle; we bequeath the sewing and knitting machine.

We received the hand printing press; we bequeath the cylinder press.

We received the type setter; we bequeath the linotype.

We received the sledge; we bequeath the steam drill and hammer.

We received the flintlock musket; we bequeath automatic Maxims.

We received the sail ship, six weeks to Europe; we bequeath the steamship Majestic, six days to Europe.

We received gunpowder; we bequeath nitroglycerin.

We received the hand loom; we bequeath the cotton gin and woolen mill.

We received the leather fire bucket; we bequeath the steam fire engine.

We received wood and stone structures; we bequeath twenty-storied steel structures on which the sky may rest.

We received the staircase; we bequeath the elevator.

We received Johnson's Dictionary with 20,000 words; we bequeath the Standard Dictionary with 240,000 words.

We received 22,000,000 speaking the English language; we bequeath 116,000,000.

We received the painter's brush and easel; we bequeath lithography and photography.

We received the lodestone; we bequeath the electro-magnet.

We received the glass electric machine; we bequeath the dynamo.

We received the tallow dip; we bequeath the arclight and the Standard Oil Company.

We received the four-inch achromatic telescope; we bequeath the four-foot telescope.

We received two dozen members of the solar system; we bequeath 500.

We received a million stars; we bequeath 100,000,000.

We received the tinder box; we bequeath the friction match.

We received ordinary light; we bequeath Roentgen rays.

We received the beacon signal fires; we bequeath the telegraph, the telephone and wireless telegraphy.

We received the weather unannounced; we bequeath the weather bureau.

We received less than twenty known elements; we bequeath eighty.

We received the products of distant countries as rarities; we bequeath them as bountiful as home productions.

We received history as events remembered and recorded; we bequeath the kinetoscope.

We received the past as silent; we bequeath the phonograph, and the voices of the dead may again be heard.

We received pain as an allotment to man; we bequeath ether, chloroform and cocaine.

We received gangrene; we bequeath antiseptic surgery.

We received the old oaken bucket; we bequeath the driven well and the water tower.

We received decomposition helplessly; we bequeath cold storage.

We received foods for immediate consumption; we bequeath the canning industry.

We received butter solely from milk; we bequeath oleomargarine.

We received the pontoon; we bequeath the Brooklyn bridge.

We received the hedgerow and the rail fence; we bequeath the barbed wire fence.

We received cement steel; we bequeath Bessemer steel.

We received unlimited dependence upon muscles; we bequeath automatic mechanism.

And the good professor might have added that sanitary science is admittedly a gift of the nineteenth century to the twentieth. Imperfect as is the science today it is immeasurably in advance of what our fathers knew and practised. Indeed it is hardly too much to say that the present century received nothing from the last except periodical plagues of the black death, leprosy and cholera and a noisome breed of pestilences which are clearly attributable to the neglect of sanitary laws.

Now these diseases have all but disappeared and in the growing light of a better day it does not require a prophet to see the coming time when not only they but consumption and the various fevers—all of which are now recognized as preventable diseases—will give way before the onward march of sanitary science.

Every day sees enlightenment on this subject growing more common among all classes of the people. Every day is marked by a distinct advance in public interest in this vital question. The stagnant cess-pool is everywhere giving place to the ventilated drain; the reeking well and slimy cistern are supplanted by marvelous systems of public water supply; a great city spends half a hundred million on a drainage canal and two great states argue before a national court its effect on the public health. Within doors, in place of the open fireplace, which roasted the shins while the back shivered with rheumatic chills, we have only to set the indicator on our thermostat and a central station, a full mile away, turns on steam to heat our rooms to a desired degree or an ammonia solution to cool them to our pampered taste. Ventilation—a word synonymous in our fathers' lexicon with a cold blast from without—is now supplied to us via the fan motor at so many cubic feet per second, duly tempered to our sense of comfort. Truly our fathers knew as little about the possibilities of latter day comfort as they knew of the laws of health.

Thomas & Smith, 14 and 16 North Canal street, Chicago, have been granted letters patent on a device for washing the befouled air of cities in connection with the fan system of ventilation. Their booklet, "Air Washing and Purifying," tells how it is done, and will be sent free upon application, mentioning Domestic Engineering. The air on its way to the fan is made to pass through a spray or curtain of water which effectually removes all foreign substances, such as cinders, dust, etc. The air then passes on to a network of baffles, or angle irons, so set as to remove by successive impacts the moisture absorbed by the air in its passage through the spray. The inventors have installed their purifier in several large buildings, notably the Chicago Public Library.

Never wears brassy
WHITE METAL CLEAR THROUGH
that's the whole story—
but it means that after once in the house it's there to stay!
No ripping out of the whole plumbing, because the tubing surface has been rubbed off, leaving it unsightly. "Benedict Nickel" Seamless Tubing may be rubbed forever,—it always remains silvery white.
253 BROADWAY, N. Y.
172 HIGH ST., BOSTON.
LAKE AND CLARK STS., CHICAGO.
BENEDICT & BURNHAM MFG CO
Waterbury Conn

THE YOUNG MOTHER.

This plate is a sample of half-tone engraving by J. Manz Engraving Co., of Chicago, Ill.

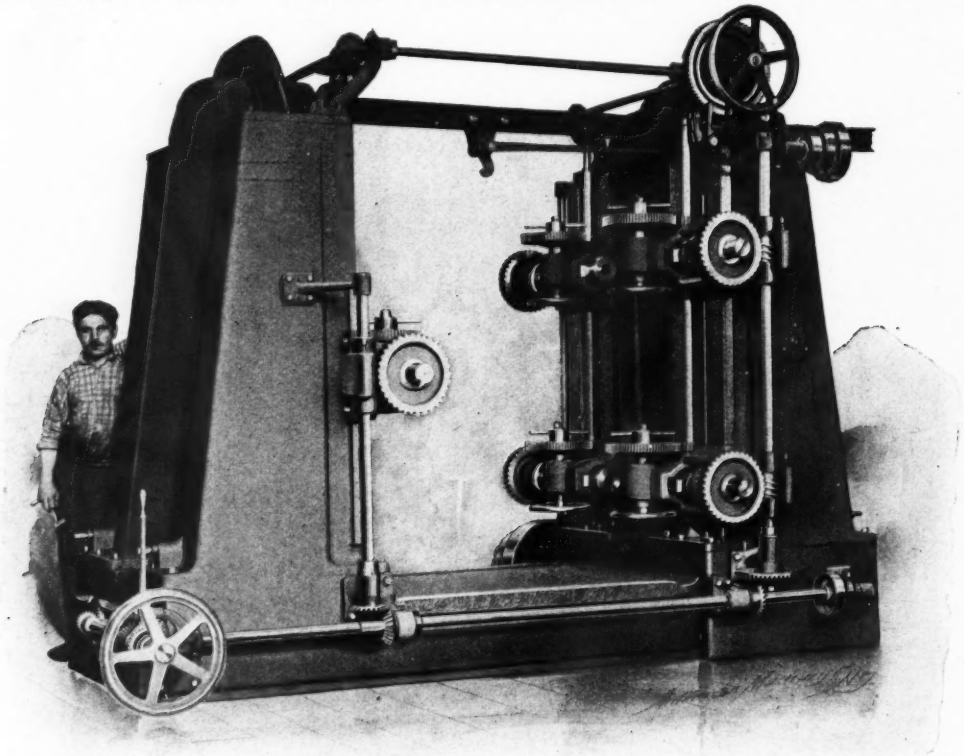
Six Spindle Drill.

The six-spindle semi-automatic machine herewith illustrated is designed for boring three part U-shaped boiler sections, which work it is capable of performing at the rate of from 6 to 10 sections per hour.

The spindles have three changes of speed, with three changes of feed for each speed, and are provided with both hand and power feed, quick advance and return, automatic stop, fine adjustment, and independent feed, and are so arranged that any one or more spindles may be thrown out of service without affecting the operation of the others, and so that each may be set to feed from any point within its range.

The heads are designed so that the spindles are supported close to the work, thus counteracting any tendency for the cutters to be deflected from truth. The two lower right-hand heads are made fast to their respective housings, while the four remaining ones are adjustable vertically by means of screws operated by a crank wrench. Two of the housings are secured to the bed-plate and two to a saddle made to adjust horizontally, either by hand or power. A pilot-wheel, located so as to afford an unobstructed view of the work, controls simultaneously all spindles in engagement.

The boiler sections are brought to the machine in a vertical position on a truck running on a track passing under an I-beam which extends out to the right of the machine. On this beam is a trolley operated by a lever, by means of which the section is lifted up and run into its jigs when the tightening of four set screws and a nut secures it in position for machining. The spindles are then advanced to the work, when the operator throws in the feed worm and waits for the machine to trip, after which he withdraws the spindles, pulls down on the elevating lever, and runs the work out, when the truck is pushed a few inches forward or back and the operation repeated on the next section.



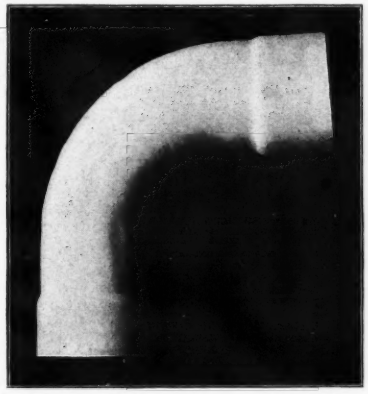
This machine is manufactured by the Bickford Drill & Tool Co., Cincinnati, O., and in addition to this boiler drill they also build a four-spindle radiator drill adapted specially for boring and facing steam and hot water radiators, which machine has a capacity of turning out 60 to 90 loops per hour. They also build a four-spindle boiler drill for steam and hot water sections, which can also be used for radiator work, although not so well adapted as for boiler sections. Upon application, mentioning "Domestic Engineering," they will be very pleased to send their new catlog "Drilling Machinery and Other Tools," which describes their full line of radiator and boiler drills, also contains cuts and full description of their large and varied line of radial drills, multiple drills and special drills.

F. W. Gleason & Co., Hyde Park, Mass., are fitting up a bath room in the residence of Mr. Sears, at that place, using Cooper's Nautilus closet, Special bath, lavatory, etc.—Adv.

John C. Gunzer, of Philadelphia, recently completed the plumbing of the Bethany Brotherhood Building, in that city. Cooper Brass Works fixtures were used throughout, including quite a number of their closets, urinals, lavatories, etc.—Adv.

NICKEL PLATED SLIP BEND.

We illustrate herewith a new nickel plated slip one-fourth bend for use in connection with nickel plated plumbing pipes where the cistern does not come directly over the closet. It does away

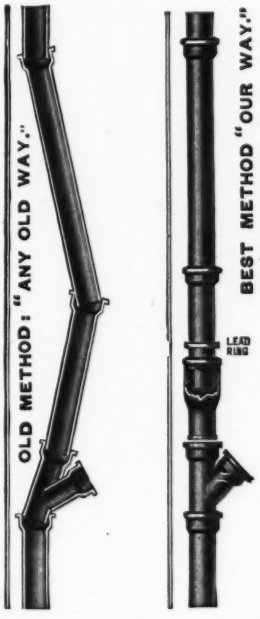


with the use of lead pipe and makes the job entirely nickel plated. It is a very neat device, and saves a plumber's time and money. It is manufactured by the Metropolitan Supply Co., 511 Grand street, New York City.

Myers & Mahoney, Portland, Me., are fitting up a fine bath room in that city, using Cooper's Nautilus closet.—Adv.

FIND READY SALE.

Boston, Mass., Nov. 19.—(From a Staff Correspondent.)—R. Estabrooks' Sons, of



South Boston, say this has been the banner year for their Sisson insertable joint. The demand from plumbers upon the jobbers handling these goods has been unprecedented, as they have found these joints very handy and invaluable as a time and money saver. The connecting of a new closet with a line of pipes already in, or, after testing a new line of pipes for leaks a defective length or cracked Y or other fitting has to be taken out, then this joint is of immediate value and labor and expense saved. The accompanying cuts show the old and new way of doing such jobs and how easy it is to insert this joint under such circumstances by cutting out of the soil pipe the length of fitting you desire to insert and 11½ inches for this joint, slip the lead ring which accompanies every joint, over the pipe above, push the joint up as far as possible, place Y or other pipe or fitting in the

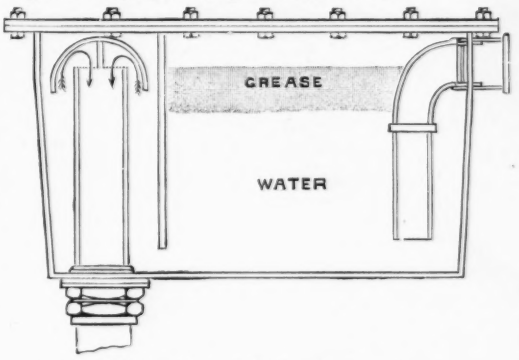
hub below and drop this joint down into it. The lead ring will drop into the joint and rest upon the shoulder inside. Place a little oakum on top of the lead ring, pour on the lead and the work is complete. The Sisson insertable joint is sold generally by jobbers throughout the country and plumbers should investigate this time, labor and expense saving invention.

David Craig, of Boston, has on hand a plumbing contract for a large warehouse in that city in which he will use several of Cooper's closets.—Adv.

A MODEL GREASE TRAP.

Boston, Nov. 19.—(From a Staff Correspondent.)—James Barrett & Son, of this city, are having marked success with their grease trap which they claim is the only mechanical grease trap on the market that will catch every ounce of grease. This trap surely has many superior points which might be enumerated, but none more conspicuous and valuable than the ease with which the same may be cleaned. This trap can be taken apart in an instant and the entire inside may be reached and easily cleaned. That has been the drawback with many traps of this kind on the market and the prospect of having a grease trap that can be so readily cleaned is appreciated.

This trap also contains an inside trap which is most serviceable in instantaneously emptying the entire contents of the grease trap after the grease has been re-



moved. If you do not desire to remove the grease simply break the coagulated grease into small particles—open the inside trap and the amply supply of cold water held by the grease trap will force the entire contents out into the main sewer. Then the trap may be instantly refilled with water and reflushed as often as desired. The water passing from the sink to the grease trap necessarily passes through the entire contents of water and through a partition into a second chamber. The water in the chamber will be just as clear as when it left the sink and outside of chamber may be anywhere from three to six inches of grease.

The philosophy of accurate catching of grease lies in having plenty of room and ample cold water, which is conspicuously attained in this trap. As many pipes as desirable may be put in and it may be tapped on sides or top if necessary. These traps are made in different sizes and the

inside partition is portable. Thus it will be seen that the water capacity of trap easily allows of the disintegration of refuse and the connecting pipes may be increased or reduced from 1½ to 4 inches. The top is in two sections and may be bolted alternately when desired or easily removed. Write James Barrett & Son, Boston, for further particulars.

W. C. Swinerton, Billerica, Mass., is placing a new bath room in the residence of Dr. Hosmer, in Bedford, using Cooper's Reno closet, Special bath, etc.—Adv.

A. H. Roop, Norristown, Pa., is renovating the plumbing in the residence of Mr. Thadeus Adle, of that city, using Cooper's Reno closets, Special baths, lavatories, sinks, trays, etc., throughout.

A Big Sprinkler Concern.

We illustrate herewith the new factory of the International Sprinkler Co., of Philadelphia, whose increasing business has rendered their old plant entirely inadequate. Some idea of the energy of the management may be gained from the fact that the orders received during the past two months more than equalled the business of the entire twelve months of 1899, a gain of over six hundred per cent. The new factory, which has just been finished, is a very complete plant, thoroughly equipped with all modern appliances, which will enable the company to handle a very large tonnage of pipes, fittings, etc. In fact, its facilities are now second to none in the business. Every one interested in the protection of property against fire will do well to look into the merits of the "International." The sprinkler is approved by the various insurance bureaus throughout the country, while many credentials have been received from leading business houses in this and other cities attesting the excellence of the International's work. All information of this character will be furnished with pleasure to prospective customers. The company will continue to have its main office in Philadelphia, and has a southern office in Atlanta, Ga. In addition it will have the advantage of the active co-operation of all the branch offices and the traveling representatives of Merchant & Co., Inc., which are located in the principal cities of this country. In conclusion, it is almost needless to say that with Mr. Clarke Merchant at its head, and the general management in the hands of Mr. Powell Evans, the International Co. has a strong practical management, abundant capital and is in the business to stay.

The International Sprinkler Company's New Factory.

The following substantial firms attest the value of these sprinklers:

Pennsylvania.—Philadelphia: Electric Storage Battery Co. (manufacturers storage batteries), Leicester and Continental Mills Co. (woolen mills), John Wolstenholme & Sons (manufacturers of worsted yarn), Hotel Walton, Quaker City Dye Works, Hensel-Colladay (repeat order) (woolen mills), Smith, Kline & French Co. (drugs), William Steele & Sons (Peter Woll) (repeat order), Estate C. J. Graham, Robert Foerderer (manufacturer of leathers), George W. Smith & Co. (cabinet makers), National Furnishing Co., John Gay's Sons, Tutleman Bros. & Faggen, Germantown Spinning Co., Bernstein Manufacturing Co. (manufacturers of metal bedsteads), Peter Woll & Sons, Greaves Bros., Marks Bros. (repeat order) (department store), John T. Bailey & Co. (manufacturers of bags, rope and twine), J. Kitchenman (manufacturer of carpets), George Lasher, Enterprise Manufacturing Co. (manufacturer of hardware specialties), R. T. Moorhouse (manufacturing of paper), J. S. Thorne, J. R. Jones, Dornan Bros. (manufacturers of carpets), Millbourne Mills, Hess' Mills, Thomas Miles Building (office building), T. B. Rice (repeat order), Standard Hosiery Co., George Watkinson & Co. (manufacturers of rubber boots and shoes), Dill & Collins, Otto Gas Engine Co. (manufacturers of gas engines). York: Ashley & Bailey Co. (manufacturers of silk). Reading: Nolde & Horst (knitting mills). Natrona: Pennsylvania Salt Manufacturing Co. (manufacturers of chemicals). Spring Grove: W. C. Urner & Co. Coplay: Lehigh Valley Silk Mills. Johnstown: Cambria Steel Co. (manufacturers of steel). Yardley: Cold Spring Bleaching & Finishing Works (Theo. C. Search, president).

New York.—Buffalo: Buffalo Forge Co.

Connecticut.—Torrington: Coe Brass Manufacturing Co.

New Jersey.—East Trenton: Crescent Belting & Packing Co. (manufacturers of rubber goods) (repeat order). Riverside: Philadelphia Watch Case Co. (T. Zerbrugg Co.), Riverside Metal Co. Millville: Millville Manufacturing Co. (cotton mills).

Maryland.—Baltimore: Sharpe & Dohme (drugs), American Tobacco Co. (Felguer branch).

District of Columbia.—Washington: Stumpf Bedding Co. (manufacturers of metal bedsteads).

Virginia.—Richmond: Richmond Locomotive and Machine Works (manufacturing locomotives). Norfolk: Cotton Oil & Fibre Co.

North Carolina.—Roanoke Rapids: Patterson Textile Co. (cotton mills), Roanoke Mills Co. (cotton mills). Fayetteville: Ashley & Bailey Co. (manufacturers of silks). Lexington: Nokomis Cotton Mills.

South Carolina.—Union: Buffalo Mills (cotton mills). Westminster: Cheswell Cotton Mills. Columbia: Capital City Mills (cotton mills). Laurens: Laurens Furniture Co. Spartanburg: Morgan Iron Works, Spartanburg Warehouse Co.

Tennessee.—Harriman: Harriman Cotton Mills.

Texas.—Denison: American Cotton Spinning Co. Roxton: Roxton Cotton Oil Co. McKinny: McKinny Cotton Oil Co.

Isaac T. Hirst, of Philadelphia, recently completed a new bath room for Mr. H. E. Spannuth, of that city, using Cooper's Nautilus closet, Special bath, lavatory, and other fixtures.—Adv.

The Schneider Instantaneous Water Heater.

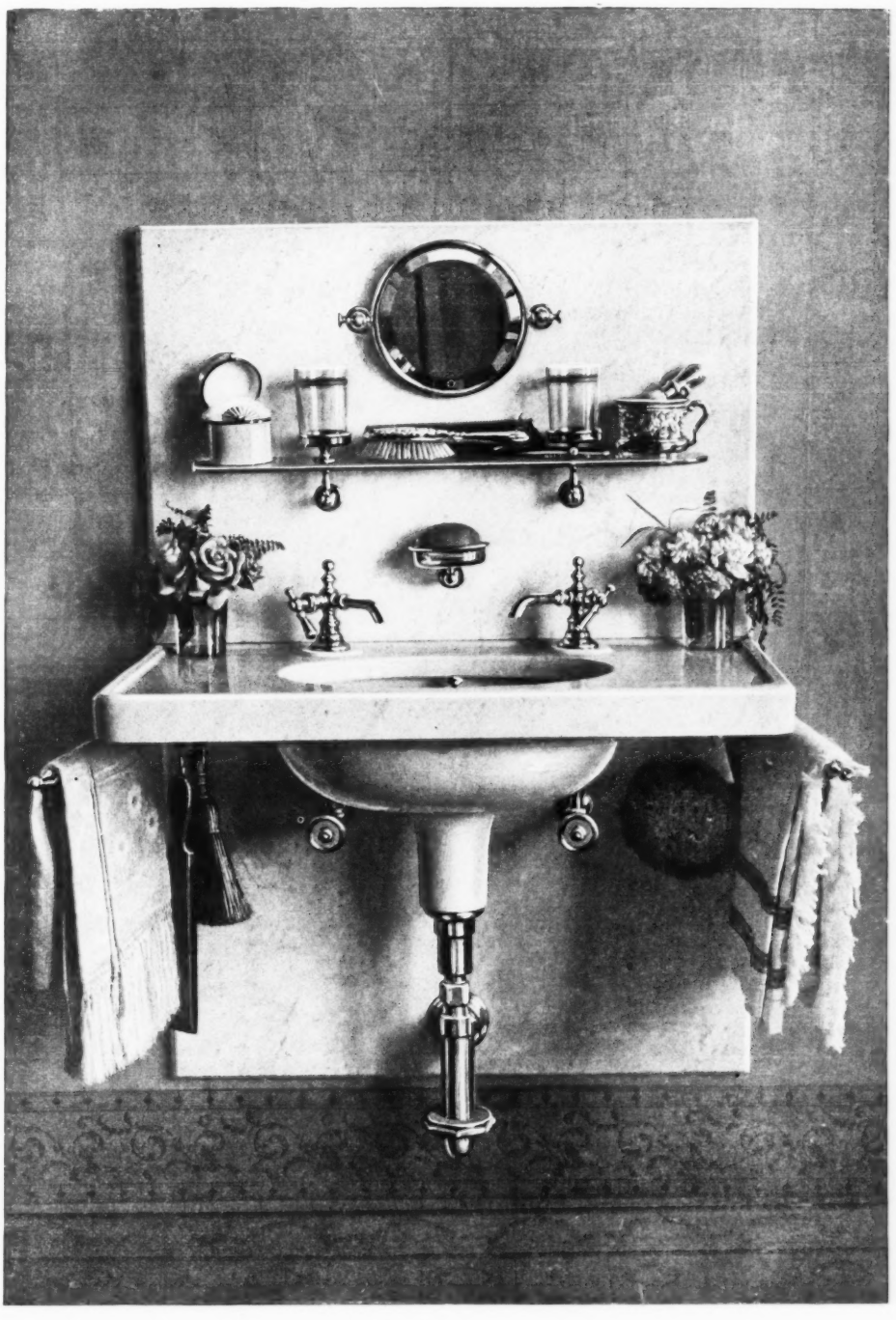
The Schneider heater has these points in its favor:

1. Its claimed efficiency is 95½ per cent.
2. There is no solder on any part to be melted by the heat.
3. It needs no drip pan.
4. It can be taken apart in sections in a few minutes.

5. There is absolutely no danger from explosions or fire as only 4½ per cent of heat escapes through the vent pipe.
6. One lever controls the water and gas, and the valve is substantially made and will not get out of order.

RIKER BASIN SYSTEM

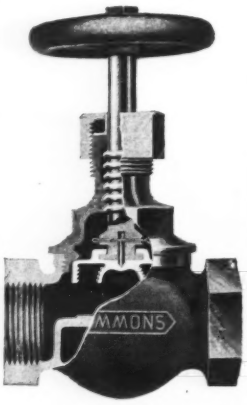
PROTECTED BY NUMEROUS AMERICAN AND EUROPEAN PATENTS



SYPHONIC action prevents overflowing and constitutes the great hygienic feature of Riker Basins; that is, ONE passage way only for both waste and overflow, with the result of an always fresh and sweet fixture. The entire inner surface of the trap and waste is reamed deadsmooth, and all broken, ragged joints and pockets for the accumulation of filth, are absolutely avoided.

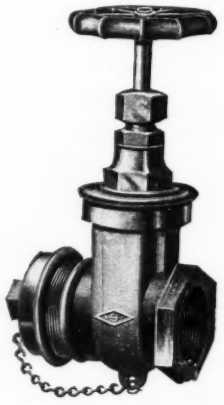
Ten minutes will suffice to remove with a brush or rag all slime which may have deposited in the waste and trap. The basin comes to you absolutely complete. Its iron back frame is screwed to studding in wall, and waste and supply connections made thereto. Plaster or tile work is then finished, and lastly, the basin attached to frame in an hour's time, and left there without mar or scratch; an ORNAMENT to the most luxuriously appointed bathroom, or an article of the utmost utility and cleanliness in some NOOK of an apartment. Prices range from $32.00 upwards, according to appointment. About 700 basins are in use at the Waldorf-Astoria, Exchange Court Building, the Astor Model Apartments of New York, and numerous business and first-class private dwelling structures.

JOHN SIMMONS CO., 110 CENTRE STREET, NEW YORK, N. Y.



THE SIMMONS VALVE
O'MEARA PATENT DISC.
MOST EASILY REMOVED SEAT MADE TO-DAY.

COMPLETE BATHROOM EQUIPMENTS OF THE MOST MODERN AND SANITARY DESIGNS.
LARGE STOCK ALWAYS ON HAND.



SIMMONS GATE VALVE FOR WATER OR STEAM.
POLISHED VALVES FOR FIRE STAND PIPES A SPECIALTY.

COMPLETE LINE OF CLOSETS

REGISTERED TRADE MARK

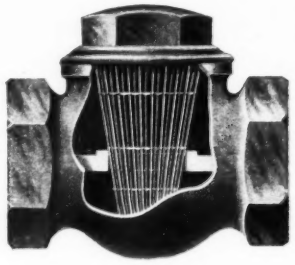
PIPE, FITTINGS AND VALVES

JOHN SIMMONS Co.

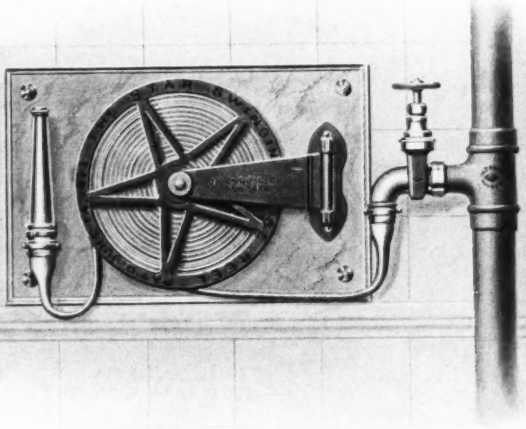
NEW YORK
106-108-110 CENTRE ST.

PIPE CUTTING SHOPS
155-7 LEONARD ST.
COIL AND BLACKSMITH SHOP
142 CENTRE ST.
YARDS AND DOCK
381 SOUTH ST.

SIAMESE FIRE LINE CONNECTIONS.
IRON AND BRASS.



SIMMONS FISH TRAP.



MATERIAL FOR FIRE STAND PIPES A SPECIALTY.

There are other reasons which will come to light when a trial is made of the heater. It is manufactured by the Schneider Closet & Heater Co., Ann Arbor, Mich., who fully guarantee it to do as they claim or they will refund the money. They claim that it is the only heater on the market that will heat 1¼ gallons of water from 42 degrees Fahr. to 120 degrees Fahr. per minute with one foot of gas at a cost of one cent for a bath of ten minutes' run.

The company is having a great success in introducing its metallic tank low down closet combinations. The tank is made of No. 24 sheet steel with nickel trimmings. The lining is of copper or lead as in wooden tanks. A space is provided between lining and jacket all around to prevent sweating. It has many hygienic qualities. It is claimed it is more durable than a wooden tank, as there are no glued joints to open. They furnish this combination with a wooden seat or with a hygienic steel enameled seat. There is a very liberal discount from prices listed and they solicit orders, mentioning "Domestic Engineering."

I. B. Thorn, of Philadelphia, has lately finished the plumbing in Mr. Gowan's new residence on DeLancey Place. Wm. S. Cooper Brass Works' goods were used throughout, including four Reno closets, Special baths, lavatories, and other fixtures.—Adv.

WELL KNOWN WOOD WORKERS.

The well known and reliable firm of Hermann Furniture & Plumbers' Cabinet Works, 368-370 Broome street, are looking after the trade very thoroughly this season. Their superior finished tanks and seats are in any desired wood, as is also their plumbers' cabinet work.

John C. Kelley & Co., of Boston, are renovating a bath room in the residence of Samuel Usher, Esq., at North Cambridge, using Cooper's closet and Special bath.—Adv.

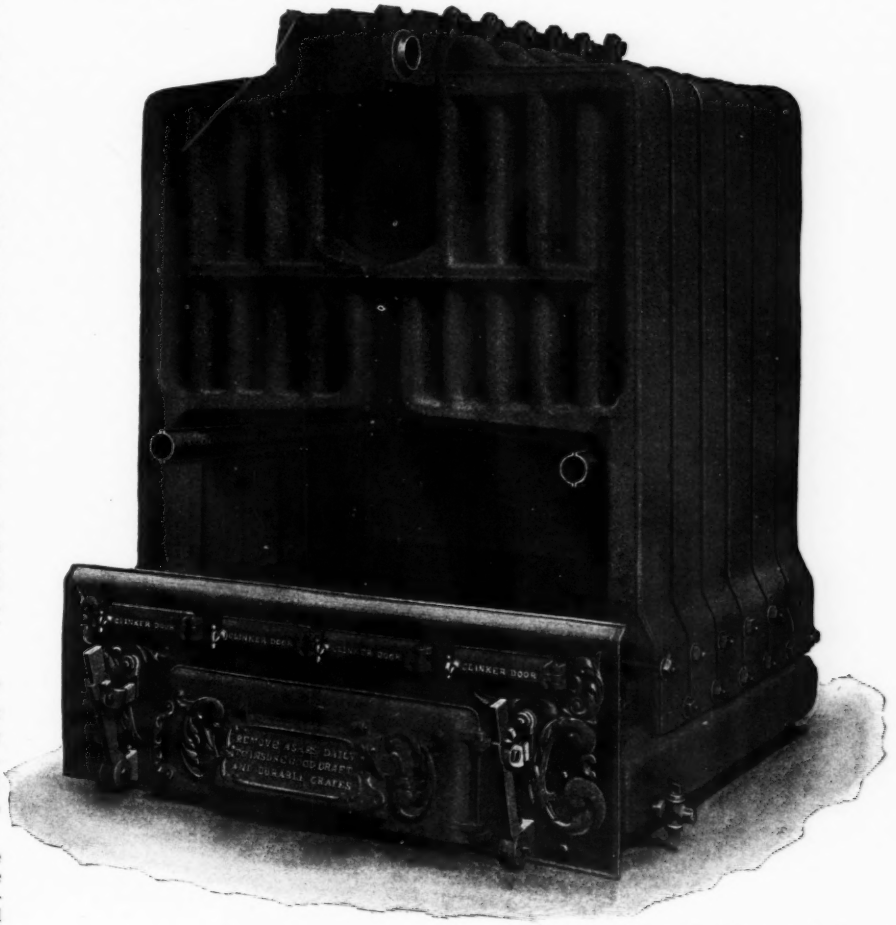
L. O. Koven & Bro., No. 50 Cliff St., New York, have recently completed a new department at their works in Jersey City for the manufacture of large sizes of galvanized and black iron hot water tanks, also galvanized and black boilers with coils inside for heating water by steam. They have these goods in stock in sizes ranging from 100 to 500 gallons capacity; this enables them to fill almost any order as soon as received.

Mr. L. O. Koven says that the demand on them for large tanks has increased to such an extent that they determined to increase their capacity in this line and at the same time, carry a stock of large boilers. They have issued a catalogue on large sizes of hot water tanks, etc. They will be pleased to send this to the trade on application (mentioning "Domestic Engineering") together with discount.

The business of this firm is very largely the manufacture of special sheet steel and sheet iron work for all branches of manufacturing industries.

THE THERMO HOT-WATER BOILER.

We illustrate herewith a No. 741 Henderson Thermo water heater with plate front and front water sections removed. In this heater it is well to call attention to the following features: In the base there are three hollow castings connected by slip nipples, which are shipped put together, but are easily taken apart if desired. The sections are of twin construction in all sizes, insuring freedom of expansion without breaking. Any half section may be removed without disturbing the rest of the heater. The sections are thus made easy to handle and pass through small openings. The header is sunk between the upper ends of the sections, permitting increased fire surface without additional height. The grate is a rocking and dumping pattern, made double in the large sizes. The fire surface is of the direct surface, vertical and horizontal type, and unusually large in proportion to the grate surface, and effectively arranged. Horizontal wrought iron slip nipples form the joints, which are all outside the fire; easy to tighten, easy to take apart. The circulation is vertical, the water heating in small columns moving rapidly with no counter currents. The heater is easily drained, and these features with the gas consuming device, the economical ratings, durability of the heater, ease in setting up and cleaning, form a very desirable type of heater. Further particulars will be sent upon application to the Prizer-Painter Stove & Heater Co., Reading, Pa., mentioning "Domestic Engineering."



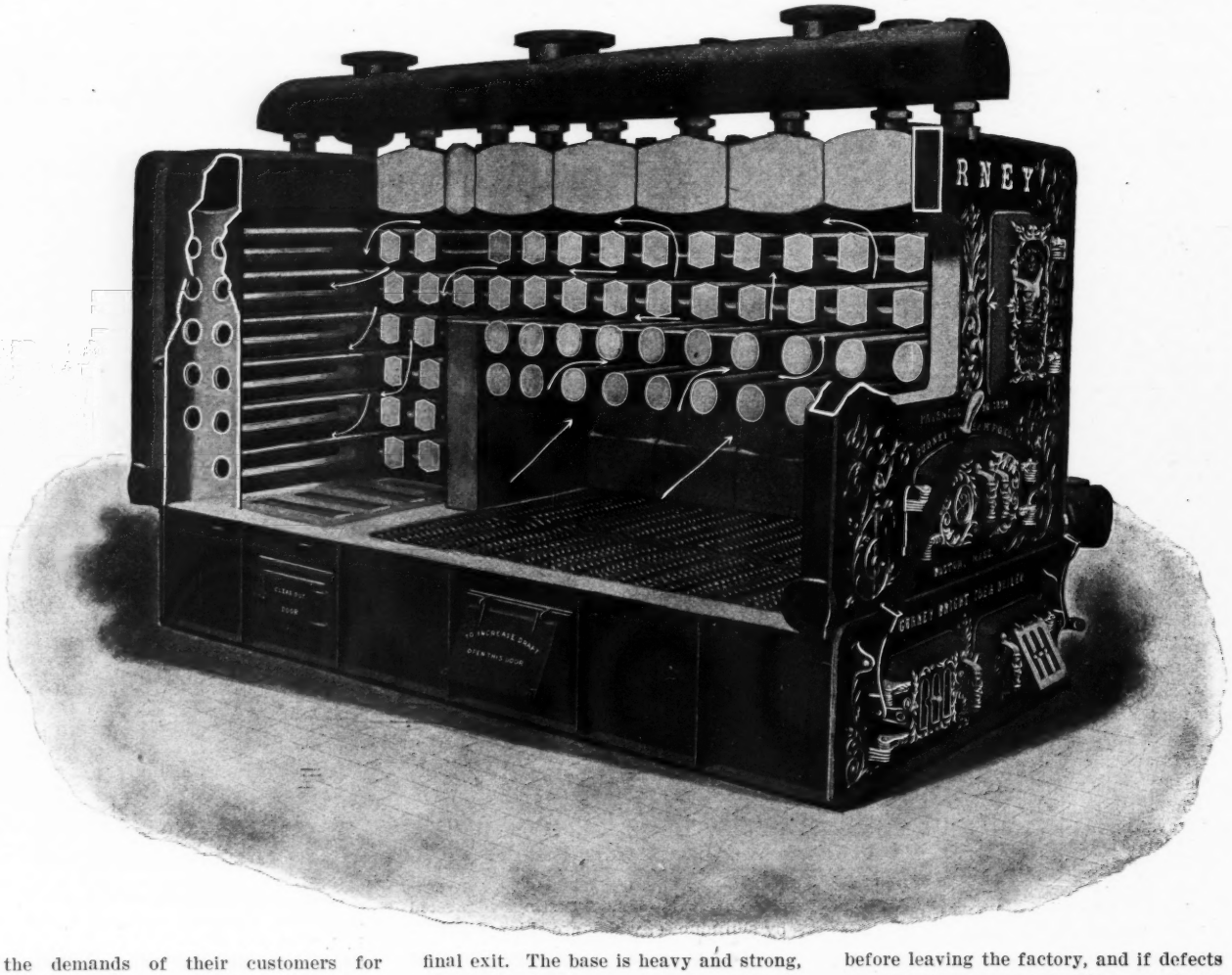
V. B. Giffin & Son, Atlantic City, N. J., recently completed the plumbing of Mr. L. I. Wright's new residence in that city, using three complete bath-room outfits of Wm. S. Cooper Brass Works manufacture, including their Atavic flushing valves. Also solid porcelain ware for the kitchen, laundry, pantry, etc.—Adv.

The National Pancoast Ventilator Co., 723 Drexel building, Philadelphia, have put out a revised price list in neat pamphlet form, in which they improve the opportunity to speak a word about the scientific principles on which their ventilators are constructed, and their perfection in action. The pamphlet is for free distribution. Please mention "Domestic Engineering" when writing for it.

Geo. B. Shainline, Bridgeport, Pa., did the plumbing work included in the alterations to the residence of Mr. Chas. Heber Clark, at Conshohocken, Pa. Two complete bath rooms were fitted up complete with Wm. S. Cooper Brass Works' Reno closets, Special baths, lavatories, etc.—Adv.

THE HEAVY DUTY BRIGHT IDEA BOILERS.

The Gurney Heating Mfg. Co., 74 Franklin street, Boston, Mass., send us a circular describing their Bright Idea heavy duty boilers, "1,200 series." We illustrate a sectional view of the hot water boiler. This series is designed to meet the demands of their customers for boilers of the Bright Idea type with a greater power and capacity for large buildings, instead of the usual wrought iron tubular or fire-box boilers. The front and back sections are single-cored castings, the inside and bridge wall sections being made in halves. All the sections, including front and back, are connected to the supply and return drums by lock nut nipples outside the boiler where the fire does not act upon them. The heating surfaces are large and effective, making the boiler very quick and powerful in its action. There is no possibility of breakage of any part of these boilers through sudden expansion or contraction, and in comparison with the usual fire tubes of wrought iron tubular boilers, this type is claimed to be more durable, efficient and economical with more effective heating surface and to be more easily cleaned and repaired. Deflecting plates on the second row of tubes compel the products of combustion to travel to the upper surface of the fire-box, then pass over the bridge wall into a combustion chamber at the rear, in which there are also large fire-tube surfaces with which the gases of combustion come in contact before making their final exit. The base is heavy and strong, and the grate dumps and rocks and is divided into two sections. Other features of this boiler are described in a very handsome circular which will be sent upon application to the manufacturers, mentioning "Domestic Engineering."



James F. Davlin, Somerville, Mass., is fitting up a fine toilet room in the ladies' department in the Central Club, of that City, using Cooper's Nautilus closets and other fixtures.—Adv.

A cluster of leaves which have fluttered to the editor's table show the working of the D. M. Steward Wonder Burners, manufactured by the State Line Talc Company, of Chattanooga, Tenn. Photometric measurements show that these burners give a very high degree of candle power. To those applying, with a mention of "Domestic Engineering," printed matter will be sent explaining the working of the Wonder burner and its peculiar adaptability to acetylene gas.

Upon request, the F. W. Webb Mfg. Co., of 52-60 Elm street, Boston, Mass., will send to those mentioning "Domestic Engineering" their new catalogue and price list of Duplex Ball Cocks. These cocks are made for top, bottom or end supply, are tested under pump pressure before leaving the factory, and if defects in material or workmanship are found after they have left the factory they will be replaced without charge.

I. B. Thorn, of Philadelphia, recently set Cooper's Special baths in some work he had on hand.—Adv.

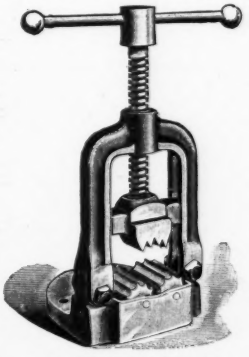
The Colwell Lead Company, of New York City, send us a catalogue of specialties which will also be sent to those writing in the name of "Domestic Engineering." Ten pages are given over to the description of the Climax Cellar Drainer, an automatic device which guarantees a dry cellar at all times. Other Climax specialties are smoke test plugs, pipe and trap closers and testing bonds. A line of plumbers' utensils bears the same name and are carefully described. The Climax Gas Machine is briefly touched upon—the company having prepared a fifty-page book for distribution among those interested.

To cast reflections is the business of Frink's patent reflectors, manufactured by J. P. Frink, 551 Pearl street, New York City. A new catalogue tells how they do it. Write to him if you have a dark corner which needs brightening up, not forgetting to give credit to "Domestic Engineering" for the tip.

Mood Plg. & Htg. Co., of Topeka, have some work on hand in which they are using Cooper's goods.—Adv.

SIMPLE BUT MOST EFFECTIVE.

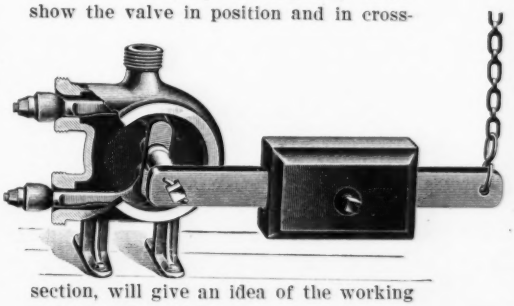
The Hollands Manufacturing Company, of Erie, Pa., have cause for jubilation just at present, Uncle Sam having granted them on November 27th a patent on a pipe vise which is unique from a mechanical standpoint. It is a radical departure from the old style "V"-shaped pipe jaws which are expensive to make. In this vise they use corrugated rollers having from twenty to twenty-five flutes.

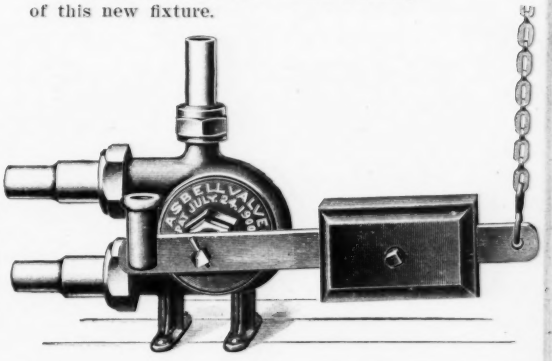


This form of grip is said to be not nearly so liable to wear and will last practically a life-time, besides being twenty to twenty-five per cent. cheaper than a good old-style vise. The principle is so simple that the wonder is that some one has not stumbled on it before.

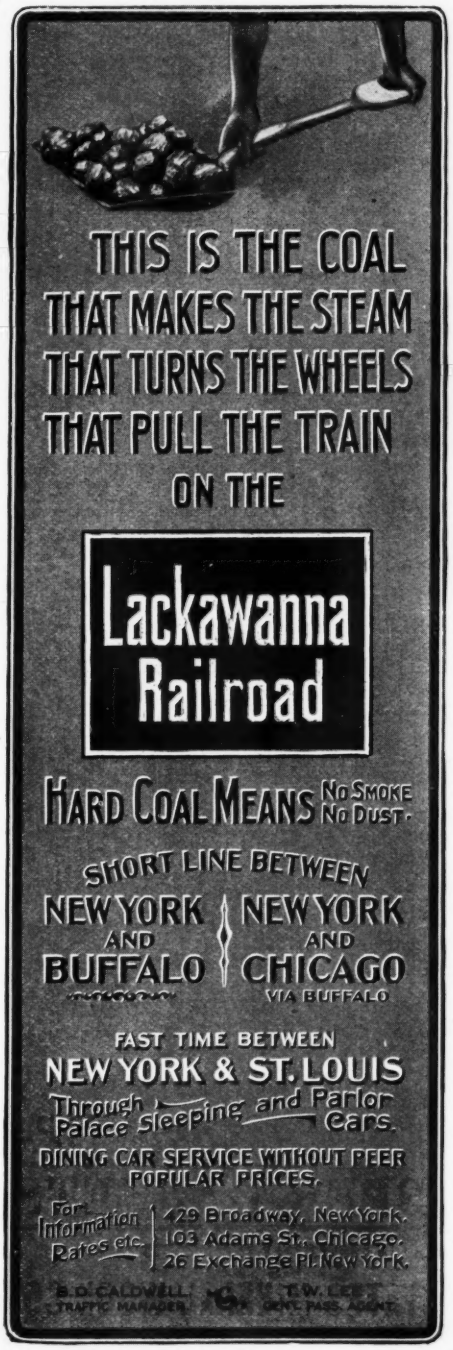
ASBELL'S NEW HOPPER VALVE.

The S. J. Asbell Co., of Paterson, N. J. has recently obtained letters patent on a frost-proof hopper valve, which is meeting with marked success, considering the short time it has been on the market. The accompanying illustrations, which show the valve in position and in cross-section, will give an idea of the working of this new fixture.





It will be seen that the valve is so constructed and arranged that not a particle of water will remain in the valve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Railroad
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Closet will rough in 12 inches.

Iron pipe size, brass supply pipe.

Lined with Four Pound Sheet Lead or Heavy Copper.

The O. K. Manufacturing Co.

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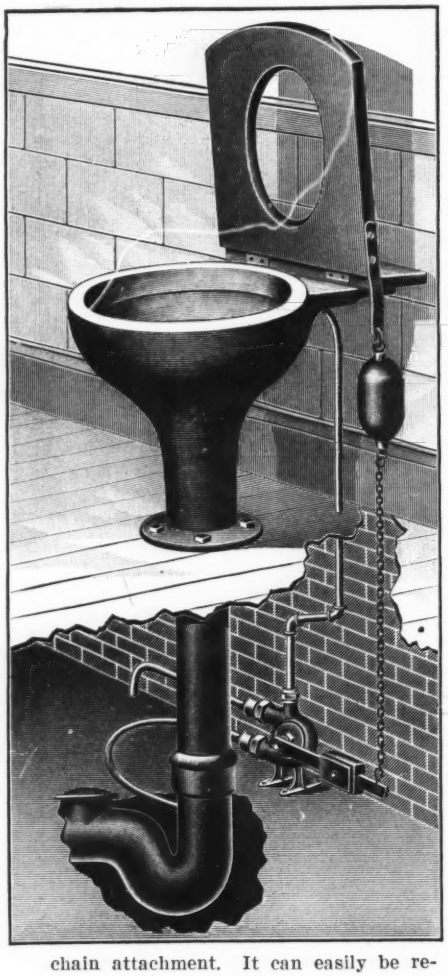
casing after the flushing of the closet, having a waste the same size as the supply therefor, making it quick wasting and frost proof.

This valve can be used on repair work without altering the seat or causing any additional expense, as it is made both ways and can be used with a rod or



chain attachment. It can easily be repaired by removing the two large couplings and inserting the two fuller balls without taking the valve from position, and can be used as a stop and waste cock by placing it in a cellar or pit below freezing point and operating with a chain.

W. J. Robinson, of Philadelphia, recently installed a new bath room in the residence of Mr. Geo. E. Evans, at Mt. Airy; all the fixtures being of Wm. S. Cooper Brass Works manufacture.—Adv.

New York Plumbing Co., Council Bluffs, Ia., have several operations on hand in which they are using Cooper's Nautilus and Reno closets.—Adv.

TRADE WANTS.

WANTED--DRAUGHTSMAN EXPERIENCED on steam heating plans and estimates. State age, references and salary expected. Address J. H. F., Room 5, 38 Pearl St., Boston, Mass. 12-8-D

WANTED—SALESMAN TO SELL OUR LINE of high grade plumbers' brass goods. Can only consider one with experience and established trade. Address with full particulars, Glauber Brass Mfg. Co., Cleveland, Ohio. t. f.

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WANTED—FOR CASH, JOB LOTS OF PLUMBing and steam fitting supplies, overstocks of such goods, or lots of goods not finding a ready sale Address "72," care of Domestic Engineering, 58-64 N Jefferson Street, Chicago. 12-1-D

FOR SALE—PLUMBING BUSINESS IN GOOD Iowa town, good clean stock which will invoice at $2000.00. Best of reasons for selling. Terms cash. Address E, care of "Domestic Engineering" 58-64 N. Jefferson St., Chicago, Ill. t. f.

WANTED—A FIRST-CLASS SALESMAN TO represent us as manufacturers' sales agent for the sale of our water and steam heaters, to the trade, in Philadelphia and vicinity. The Prizer-Painter Stove & Heater Co., Reading, Pa. 1-5

FOR SALE—A FIRST CLASS PLUMBING AND heating business in a Nebraska town of ten thousand; established for fifteen years with work enough for at least six months in good contracts. Apply to J. M. care of "Domestic Engineering." 1-1901

WANTED MEN—THERE MAY BE THREE men in jobbing or manufacturing houses in Chicago who want to improve their positions or who desire to change; or there may be some young men in country plumbing establishments who are looking for a wider field for their ability. We can use one, two, or even three such men who understand the plumbing supply business and who can do something. We don't want children to bring up, but if there are any young men who know they can do work inside a jobber's office or sell goods in Chicago and the country, they can write fully in confidence, as no letters sent in response to this advertisement will be divulged. Address "Searcher," care of Domestic Engineering, 58-64 N Jefferson Street, Chicago. 12 29-Dec

Practice talks louder than precept, and a good illustration makes a good argument. A "Wincester" heater installed sells more than a glib tongued salesman. Fitters please notice. For steam or water. Smith & Thayer Company, Boston, Mass.

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Monthly Edition

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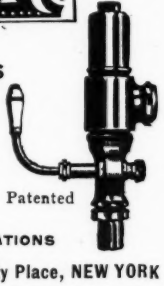

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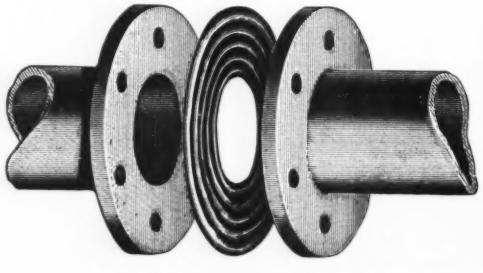

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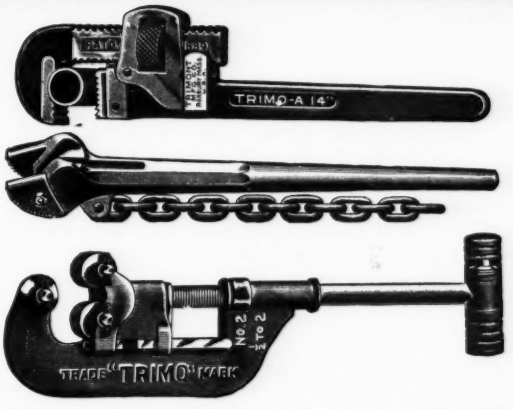

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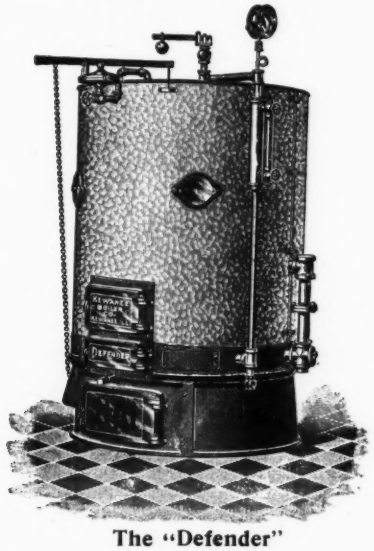

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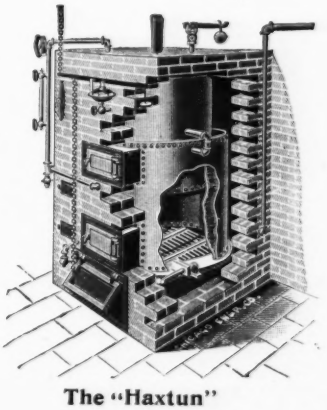
not to mention the "Tabasco" and our Tubular patterns. We have built entirely new and greatly enlarged shops and have added new machinery, in an endeavor to make our capacity equal to the demand made on us by our good friends. We made and shipped in November more boilers than we ever made or shipped in any month before. We received more orders in November than we filled old orders. We thank you and ask for more.

The "Great Northern"



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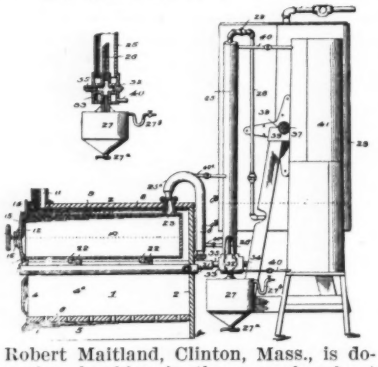
PATENTS AND INVENTIONS

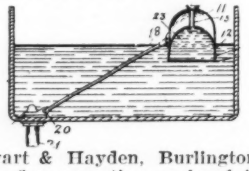
The cuts illustrating patents and inventions in this department of Domestic Engineering are furnished by Oscar A. Michel, Solicitor and Registered Attorney for American and foreign patents, at 302 Broadway, New York City, and 639 F Street, N. W., Washington, D. C. Anybody desirous of having a patent or invention illustrated will please correspond with Mr. Michel regarding it.

659,276—Acetylene gas generator. B. F. Williams, Quanah, Texas.



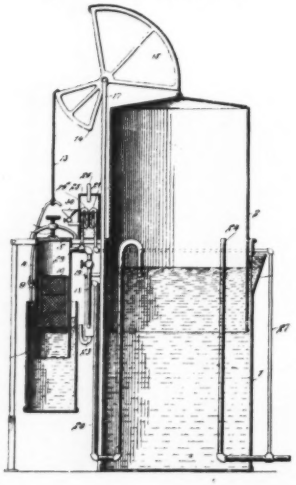
Robert Maitland, Clinton, Mass., is doing the plumbing in the new church at Clinton, using Cooper's Reno closets.—Adv.

659,819—Valve float for flush tanks, Benj. F. Lockwood, Jamestown, N. Y.

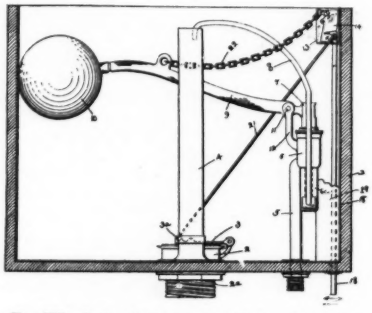


Stewart & Hayden, Burlington, Iowa, have a fine operation on hand in which he is furnishing one of Cooper's filters.—Adv.

660,889—Acetylene gas machine. Joseph M. Coghlan, Sayville, N. Y.

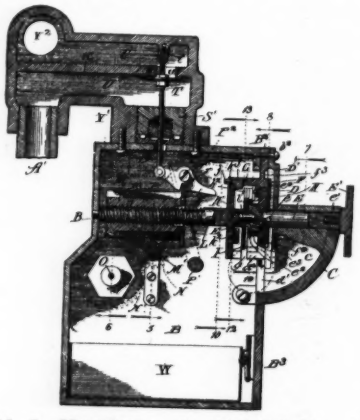


660,554—Sanitary flushing device. August F. Blesch and Edward Palmer, Columbus, O.



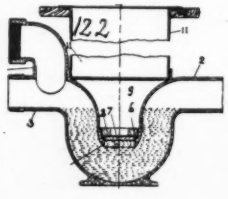
R. Weston, Saginaw, Mich., has three handsome bath rooms on hand, in which he is installing Cooper's goods, including their Nautilus closets.—Adv.

660,940—Prepayment gas meter. John Zander, Chicago, Ill.

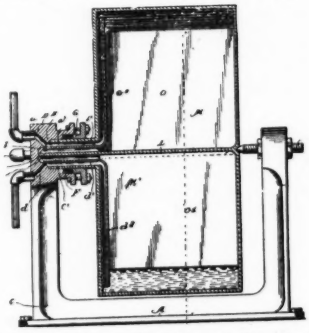


M. L. Hamilton, of Philadelphia, is overhauling the plumbing in the house of Mr. Boswell, using Cooper's Nautilus closet.—Adv.

661,122. Trap. Timothy J. Fitzpatrick, Boston, Mass.

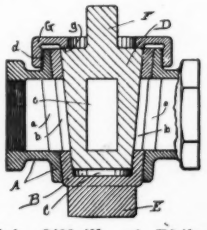


660,585—Steam trap. Edward E. Parker, Woburn, Mass.



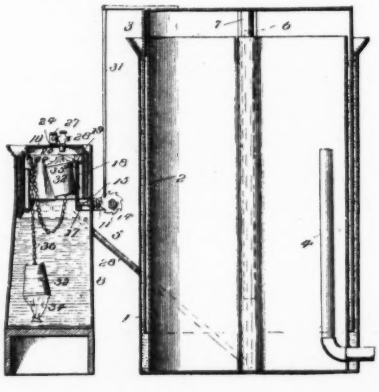
H. Schleuning, Allegheny, Pa., has a contract on hand in which he is furnishing one of Cooper's filters.—Adv.

661,175. Valve. Samuel Haigh, Cincinnati, Ohio.



Frederick O'Neill, of Philadelphia, is placing Cooper's Sitz bath in the residence of Mr. Sloan, that city.—Adv.

661,547. Acetylene gas generator. Thos. D. McClary, Washington, D. C., assignor to the Acetylene Lighting Company, of Virginia.



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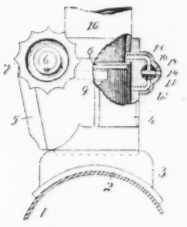
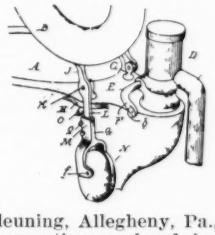
BOX 987, SCRANTON, PA.

660,760 — Tapping machine. Oscar Mueller, Decatur, Ill., assignor to the H. Mueller Manufacturing Company, same place.



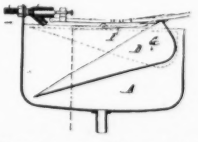
Grand Island Plumbing Co., Grand Island, Neb., has some good work on hand in which they are using Cooper's Nautilus closets.—Adv.

660,977—Seat-controlled valve-operating mechanism for water-closets. William Taylor, Detroit, Mich., assignor to the Ideal Manufacturing Company, same place.



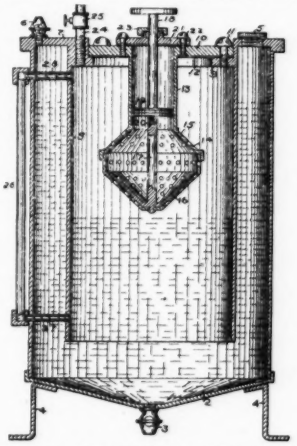
H. Schleuning, Allegheny, Pa., has several nice operations on hand, in which he is using Cooper's closets.—Adv.

661,171. Automatic Flushing and Discharging Apparatus for Sanitary or Other Purposes. Max Gautier, Brussels, Belgium.



James Openshaw, Newport, R. I., has some work on hand in which he is using Cooper's Nautilus closets.—Adv.

661,320. Acetylene-Gas Generator. Lafayette D. Railsback, Indianapolis, Ind.



LeValley, McLeod & Co., Elmira, N. Y., recently set Cooper's Nautilus closet with Atavic flushing valve in a job they had on hand.—Adv.

W. T. FITZGERALD & CO.

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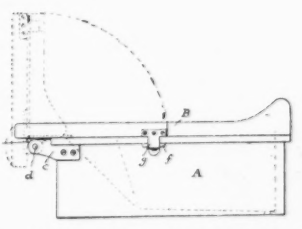
662,035. Gas-Burner. Clarence S. Steward, Chattanooga, Tenn.

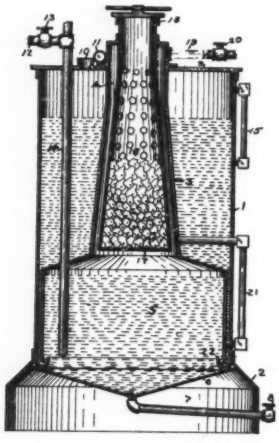
Carey & Bro., Media, Pa., recently placed Cooper's Nautilus closet, Special bath with overhead shower, etc., in the residence of Mr. Wirtz, of that city.—Adv.

661,703. Combined bath-tub and couch. William R. Permar, Baltimore, Md., assignor of one-third to Charles E. Jones, Cheapside, Va.



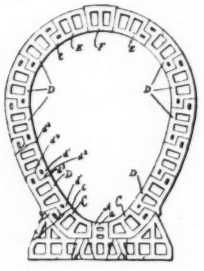
Peter Forye & Bro., Wilkes-Barre, Pa., are doing some repair work in a residence, using Cooper's Nautilus closet.—Adv.

661,321. Acetylene-Gas Generator. Lafayette D. Railsback, Indianapolis, Ind.



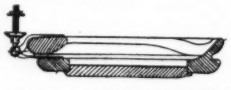
John R. Blinkhorn, of Philadelphia, recently set two of Cooper's Reno closets, Special baths, etc., in the residence of Miss Blodnor, that city.—Adv.

661,286. Sewer. Charles E. Colton, Syracuse, N. Y.



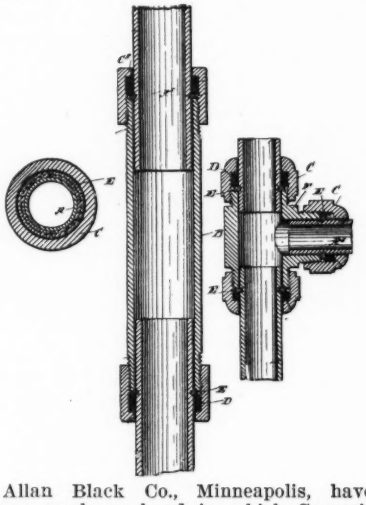
Stinson, Kennedy & Co., of Pittsburg, have some work on hand in which they are using one of Cooper's closets.—Adv.

661,441. Closet Seat and Lid. Hiram T. Bush, Detroit, Mich.



John C. Gunzer, Chestnut Hill, Philadelphia, has some work on hand in which he is using one of Cooper's closets.—Adv.

661,352. Fitting. John R. Moody, Perry, Iowa.

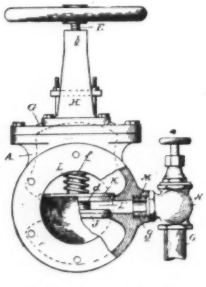


Allan Black Co., Minneapolis, have some work on hand in which Cooper's Nautilus closets are being used.—Adv.

We are making a specialty of fine China articles for metal mountings. Scalp marks and China handles of every description. Samples furnished on application.

THOMAS MADDOCK & SONS,
TRENTON, N. J.

660,995—Double-seated valve. Charles F. Murray, Wyandotte, Mich., assignor of one-half to Charles Lorimer, Shabbona, Mich.

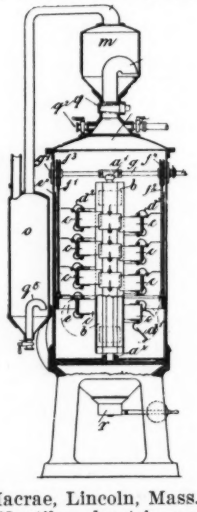


35,483. Pipe, Pipe-Couplings and Pipe-Fittings. Central Foundry Company, Newark, N. J., and New York, N. Y.

SECURITY

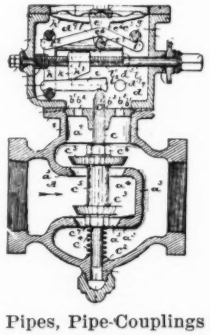
John Cowley, Pittsburg, Pa., is remodelling the plumbing in a residence in that city, using Cooper's Nautilus closet.—Adv.

662,504. Acetylene-Gas Generator. Philipp Schreck, Versoix, Switzerland.



Isaac Macrae, Lincoln, Mass., is setting Cooper's Nautilus closet in a residence in that city.—Adv.

660,872—Pressure regulating or reducing valve. Percy B. Taylor, Newark, N. J.

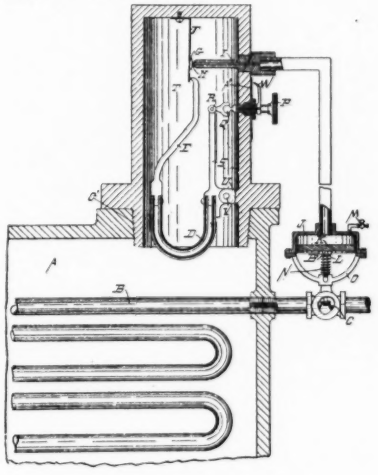


35,484. Pipes, Pipe-Couplings and Pipe-Fittings. Central Foundry Company, Newark, N. J., and New York, N. Y.

SANITAS

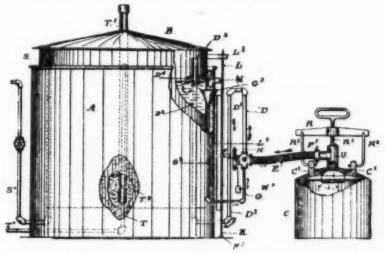
A. L. Hersum, Boston, is setting one of Cooper's Nautilus closets, Special baths, etc., in a residence in that city.—Adv.

662,092. Automatic Temperature-Regulator for Water-Heaters. Alfred Roesch, Bridgeport, Conn., assignor to the Davis & Roesch Temperature Controlling Company, of New Jersey.



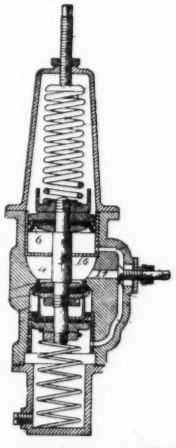
Edw. J. Sage, of Philadelphia, recently set one of Cooper's low down Nautilus closets in the residence of Mrs. Trimble at Media, Pa.—Adv.

661,284. Acetylene-Gas Generator. Henry E. Brunner, Haywards, Cal.



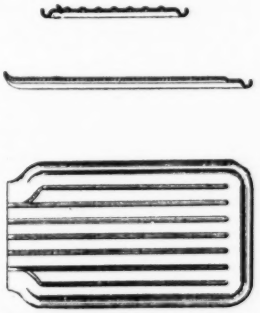
P. J. Glennon, Seattle, Wash., has three handsome bath rooms on hand in which he will use Cooper's Nautilus closets.—Adv.

662,013. Water-Pressure Regulator. Oscar Mueller, Decatur, Ill., assignor to the H. Mueller Manufacturing Company, Incorporated, same palce.



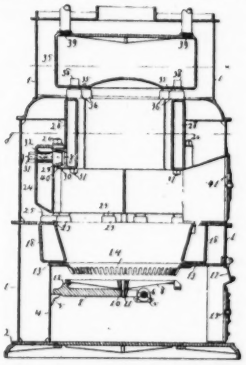
James A. McEntee, of Philadelphia, is plumbing the addition to the Colored Home in that city, using Cooper's Reno closets, Special baths and lavatories, sinks, trays, etc., throughout.—Adv.

33,465—Drain-board for sinks. Jonh H. Gavin, Chicago, Ill., assignor to the L. Wolff Manufacturing Company, same place.



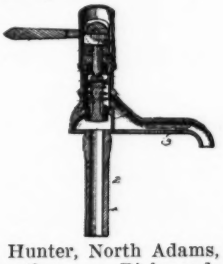
G. Wilbur Thompson, Newton Center, Mass., is plumbing a private residence in that city, in which he will use one of Cooper's Nautilus closets.—Adv.

661,116. Hot-Water Heater. William L. Dannahower, Kansas City, Mo.



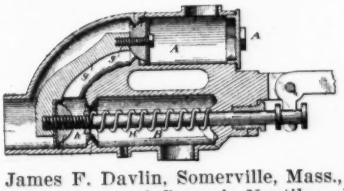
A. Hattersley & Sons, Ft. Wayne, Ind., have a fine alteration on hand in which they are using Cooper's Nautilus closets.—Adv.

661,003—Self-closing cock or faucet. Frank H. Stahl, Charlestown, W. Va., assignor to the Powhatan Brass and Iron Works same place.



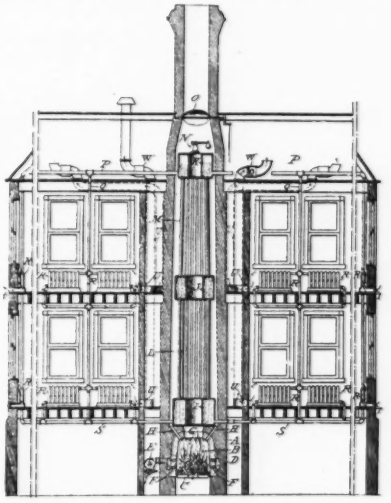
A. W. Hunter, North Adams, Mass., is plumbing the new Richmond Hotel in that city, using twenty-eight of Cooper's closets, lavatory fittings, etc.—Adv.

661,885. Flushing-valve. Fred W. Meyer, Louisville, Ky.



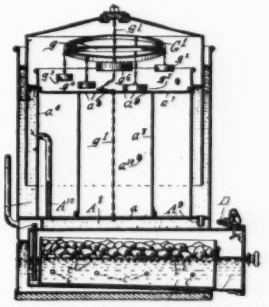
James F. Davlin, Somerville, Mass., recently set one of Cooper's Nautilus closets in some good work he has on hand.—Adv.

662,103. Heating and Ventilating System. Isaac D. Smead, Toledo, O.



Jas. Tucker & Son, of Boston, are remodeling the plumbing in a residence in that city, using three of Cooper's Nautilus closets.—Adv.

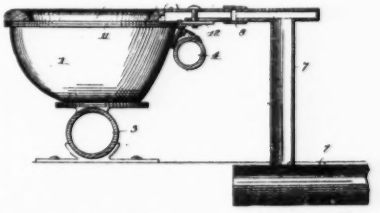
661,333. Acetylene-Gas Generator. Geo. L. Wilson, Oak Park, Ill.



Webster, Harrigan & Reid, Detroit, Mich., have some repair work on hand in which they are using Cooper's closets.—Adv.

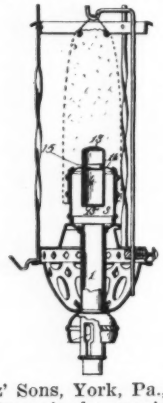
661,604. Pipe-hanger. Peter Grabler, Mansfield, Ohio.

661,454. Water Closet. Louis D. Lawnin, Edwardsville, Ill., assignor to the N. O. Nelson Manufacturing Company, St. Louis, Mo.



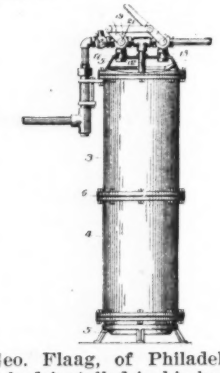
Frederick O'Neill, of Philadelphia, is plumbing a residence on North Seventeenth street, in which Cooper's Special baths, lavatories, Nautilus closets, etc., are being used.—Adv.

662,324. Incandescent Gas-Burner. Clarence W. Taylor, Sioux City, Ia.



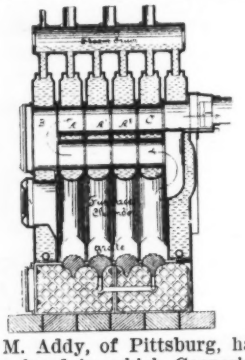
John Getz' Sons, York, Pa., are installing one of Cooper's showers in a residence in that city.—Adv.

661,339. Filter. Albert R. Grever, Philadelphia, Pa.



Mr. Geo. Flaag, of Philadelphia, has recently had installed in his house one of Cooper's filters.—Adv.

662,080. Steam-Boiler. Andrew Mercer, New York, N. Y., assignor to the H. B. Smith Company, Westfield, Mass.

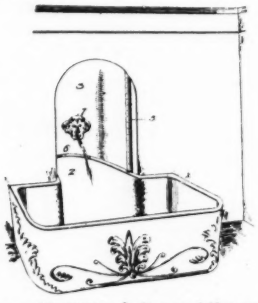


John M. Addy, of Pittsburg, has some work on hand in which Cooper's Nautilus closets are being used.—Adv.

33,503. Argand Burner for Acetylene Gas. Demetrius M. Seward, Chattanooga, Tenn.

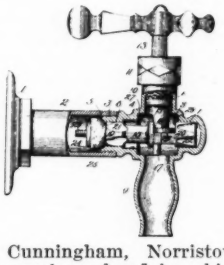
J. J. Hanighen, of Omaha, has just installed a large quantity of jet urinals in the new C., B. & Q. R. R. Depot at that city. These were furnished by Wm. S. Cooper Brass Works, of Philadelphia.—Adv.

661,351. Bath-Tub. Alfred J. Manning, Irvington, N. Y.



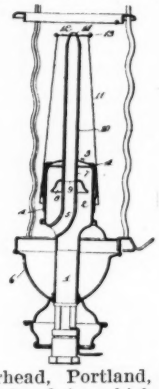
Herman H. Russ & Sons, Albany, N. Y., are doing some work in the Masonic Temple using Cooper's Nautilus closets throughout.—Adv.

661,966. Water-Faucet. John P. Farley, Kansas City, Mo., assignor to the Crampton-Farley Brass Company, same place.



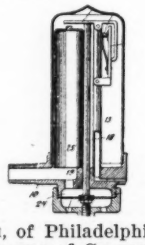
Harry Cunningham, Norristown, Pa., has some work on hand in which Cooper's low-down closets are being used.—Adv.

662,321. Incandescent Gas-Burner. Aaron P. Storrs, Owego, N. Y.



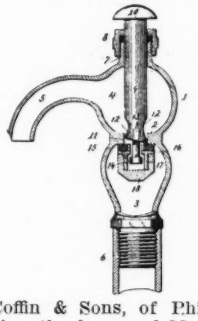
Wm. Muirhead, Portland, Ore., has a contract on hand in which he is using Cooper's Nautilus closets.—Adv.

662,093. Air-Vent. Alfred Roesch, Bridgeport, Conn., assignor to the Davis & Roesch Temperature Controlling Company, of New Jersey.



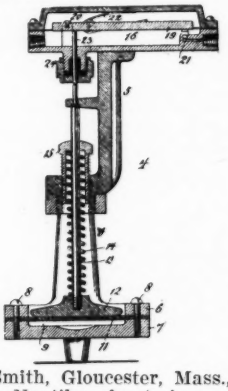
M. Leinau, of Philadelphia, has recently installed some of Cooper's goods in an operation he has on hand.—Adv.

662,503. Water Faucet. Richard H. W. Schmidt, Kansas City, Mo.



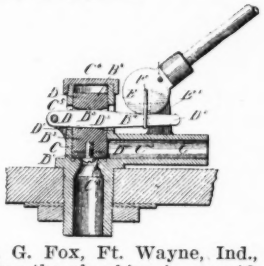
Harry Coffin & Sons, of Philadelphia, are plumbing the house of Mr. Scott, at Overbrook, using Cooper's Nautilus closets, Special baths, etc.—Adv.

662,094. Pressure-Governor. Alfred Roesch, Bridgeport, Conn., assignor to the Davis & Roesch Temperature Controlling Company, of New Jersey.



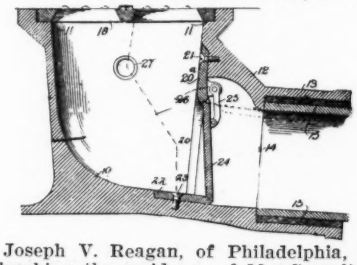
L. E. Smith, Gloucester, Mass., is setting some Nautilus closets in a residence in that city.—Adv.

662,837. Float-Valve. Edward A. Valiquette, Rutland, Vt.



Chas. G. Fox, Ft. Wayne, Ind., is remodelling the plumbing in a residence in that city, using Cooper's Nautilus closets.—Adv.

662,711. Catch-Basin or Fresh-Air Inlet. William H. Dewar, New York, N. Y.



Joseph V. Reagan, of Philadelphia, is plumbing the residence of Mr. Cornelius Haney, using Cooper's goods throughout, including Nautilus closets, Special baths, lavatories, showers, laundry and kitchen goods.—Adv.

Carried off Highest Honors

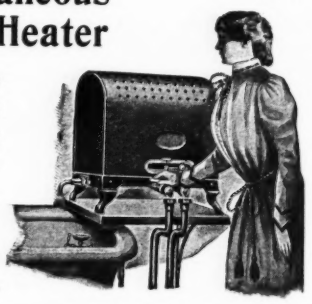
These are the Medals awarded The Trenton Potteries Company at the Paris Exposition. Two Gold Medals—one in the Department of Hygiene on Sanitary Fixtures; the other in the Department of Ceramics, on Decorative Ware and Designs on Sanitary Ware generally. The Trenton Potteries Company was the **only exhibitor that received two gold medals** on this class of goods—solid porcelainware and closets—**the highest award granted.**

Trenton Potteries Co., Trenton, N. J.

Sells to Wholesalers Solely.

The Victor Instantaneous Water Heater

is the cheapest, the most efficient and the neatest water heater made. It occupies but little space and is always ready, furnishing hot water in a few seconds, day or night.



The Victor received the highest award at the Omaha Exposition in 1898.
Write for descriptive circular, prices, discounts, etc.

W. J. ADAM....JOLIET, ILL.

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LAWSON'S

GAS WATER HEATER?

EFFICIENT, ECONOMICAL, COMPACT, MADE IN 3 SIZES.

Can be readily attached to an ordinary boiler at a very small cost.
Circulars gladly sent on application.

L. S. LAWSON, Mfg., 222 EIGHTH AVENUE HOMESTEAD, PA

Good Goods Only at Factory Prices.....

Good buyers want to know what that means. They may learn by asking for a catalogue of our imperishable Sanitary Laundry Trays and Sinks.

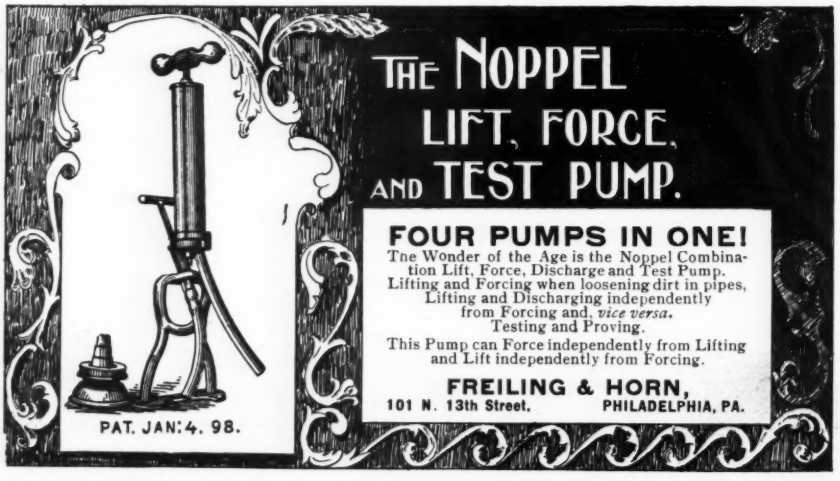
Chas. Graham Chemical Pottery Works

110, 132 Metropolitan Avenue
Brooklyn, New York

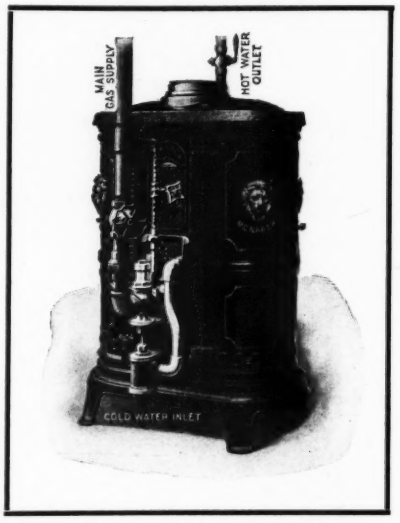
Pat. Sept. 24, '95
Pat. Jan. 4, '98

EVERY PLUMBER

In the United States should have a NOPPEL PUMP


THE NOPPEL
LIFT, FORCE,
AND TEST PUMP.
FOUR PUMPS IN ONE!
The Wonder of the Age is the Noppel Combination Lift, Force, Discharge and Test Pump.
Lifting and Forcing when loosening dirt in pipes,
Lifting and Discharging independently from Forcing and, *vice versa*.
Testing and Proving.
This Pump can Force independently from Lifting and Lift independently from Forcing.
FREILING & HORN,
101 N. 13th Street. PHILADELPHIA, PA.
PAT. JAN. 4. 98.

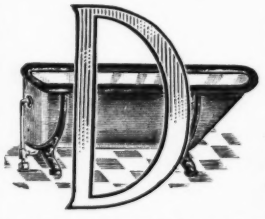
"MONARCH" LEADS



The "MONARCH" Automatic Instantaneous Water Heater, is the first and the best; in fact 'tis the "survival of the fittest".
Send for Catalog fully illustrated and you will be convinced.

MONARCH WATER HEATER CO.,

306 Wood St. Pittsburg



DAY Sanitary BATH TUBS...

We originated STEEL, ENAMEL AND STEEL CLAD BATHS, and claim superiority over all others. Our new list is out, shall we send you one?

DAY METALLIC MFG. CO., Detroit, Mich.

The GENESEE No. 10

Frost Proof Automatic Water Closet

For outside locations where other closets will freeze. Perfectly frost proof in zero weather. Tank and pipes always empty except when closet is in actual use. Cannot be used without discharging itself; no water left above frost line.

Ask for catalogue of other goods.

Genesee Automatic Closet Co.

ROCHESTER, N. Y.

OAKUM PACKING AND ROPE

Planet Mills Mfg. Co.

335 Carroll St. BROOKLYN, N. Y.

THEORY AND PRACTICE OF

LEAD BURNING

By the Autogenous Process

OR HOW TO SOLDER WITHOUT SOLDER

With full instructions to the amateur in the details of the machine and the management of the gases, with valuable suggestions and directions for practice

BY AN EXPERT

Every Plumber Should Have This Book

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Hydrants and Street Washers

The cheapest and most durable on the market.

Guaranteed to give entire satisfaction

We also make all styles of "McNAMARA" PATTERN HYDRANTS

Carried in stock by all Jobbers

WRITE YOUR DEALER FOR PRICES

JOHN G. KUPFERLE

ST. LOUIS

Steel pipe is easily and accurately threaded with our modern tools

The Oster Mfg. Co.

8 East Prospect Street, Cleveland, Ohio

Points which are of interest to plumbers

WE GIVE YOU WHAT YOU WANT WHEN YOU WANT IT AND AT THE RIGHT PRICE

YOU ARE THINKING of what you may need at this season of the year.

SUGGESTIONS

Plumbers' Torches, Thawing Steamers, Closet Repair Connections, Plumbers' Furnaces, Steam hose, etc., etc.

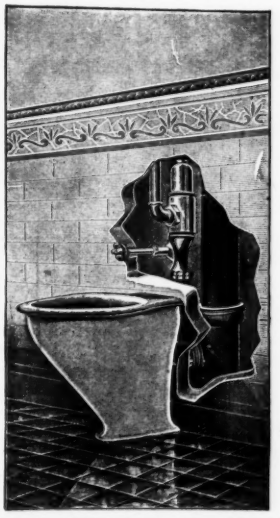
MAY WE SUPPLY YOUR WANTS?

WE HANDLE EVERYTHING IN PLUMBING, GAS, STEAM AND WATER SUPPLIES

Have you our Catalogue, Memorandum Book and Calendar?

SANITARY SPECIALTY MFG. CO.

55-57 North Clinton Street 24-30 Milwaukee Avenue CHICAGO, ILL



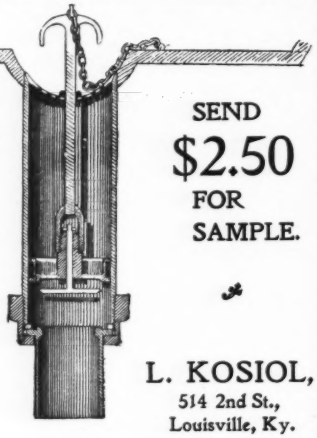
National Enameled Iron Jail Closet

Simple, durable and easily adjusted. No overhead tanks required. Cannot be tampered with—no movable parts being exposed.

MANUFACTURED BY

The National Supply Company

TOLEDO, OHIO



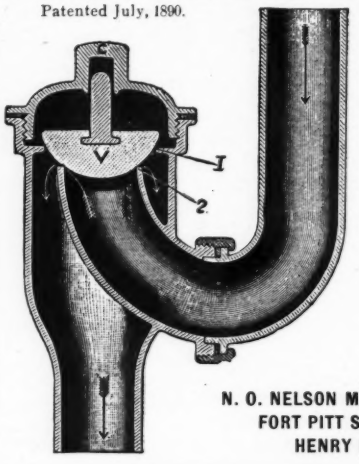
Kosiol's
Perfected
Sink
Waste

SEND
$2.50
FOR
SAMPLE.

L. KOSIOL,
514 2nd St.,
Louisville, Ky.

THE SECURITY TRAP

Patented July, 1890.



Seal: Cannot be reduced in any degree by most severe syphonic action.

Evaporation: Ball rests in such a way that it is impossible for water to evaporate.

Back pressure: Positively safe against it.

Noise: No roaring.

GET PRICES.

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211 S. Ninth St.
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N. O. NELSON MFG. CO., St. Louis, Mo.
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HENRY McSHANE MFG. CO., Boston.

WORDS OF WISDOM

"Do not advertise and stop,
But advertise and stay,
For those who read your ad last week,
Will look for it to-day."

STRONG TAGS For SUBSTANTIAL BUSINESS.

WIRE STRUNG TAGS A SPECIALTY

ALWAYS READY

THE AMERICAN MFG COMPANY.
BATTLE CREEK, MICH.
MANUFACTURERS OF
SHIPPING TAGS.

STRONGEST SHIPPING TAGS IN MARKET

Lausten Lead Works

PRATT AND MORGAN STREETS
CHICAGO

Bi-metallic specialties
Lead traps and bends

Write for prices

Lead pipe, sheet lead
Ebony gloss plumbers' soil

A record breaker

Boils water in
1½ minutes

This heater with gas attachments for heating water to a high temperature with unequal rapidity and economy cannot be surpassed by any heater on the market. Adapted for bath rooms, etc. Send for catalog.

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South Norwalk, Conn.

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Stambach & Love

Plumbing Supplies and
Sanitary Specialties

50 AND 52 N. SEVETH STREET
PHILADELPHIA

City Delivery & Shipping Dept.
Telephone Call, 2302 Main

Main Office
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Thomas G. Knight

Plumbers' Steam and Gas Fitters' Supplies

WAREHOUSES:
351-353 & 364 Jay Street
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OFFICE: 359 PEARL ST.,
BROOKLYN, N. Y.

John Simmons Co.

110 Centre Street
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TRADE MARK

IRON PIPE, FITTINGS AND VALVES
FOR THE PLUMBER, STEAM- AND GAS-FITTER.

CAST-IRON SOIL PIPE
DRAINAGE FITTINGS
IMPROVED BATH-ROOM FIXTURES

"The Thrush, enrapturing heaven and earth."

THE
"Thrush"
LOW TANK
SYPHON
JET
CLOSET
COMBINATION

We have others.

COLWELL LEAD COMPANY
63 Centre St., New York

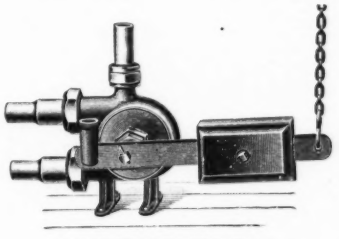
Telephone 640—38th Street
" 641 " "

John A. Murray

MANUFACTURER AND JOBBER OF

PLUMBERS', STEAM AND GAS FITTERS' SUPPLIES

625 AND 627 SIXTH AVENUE NEW YORK



Patented July 24, 1900.

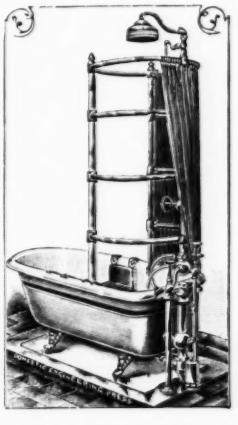
Try It
and you will use no other.

ASBELL'S
FROST PROOF
HOPPER VALVE.

SEND FOR DESCRIPTIVE CIRCULAR AND PRICE.

THE S. J. ASBELL COMPANY
Van Houten St., near Cross St., PATERSON, N. J.

Mention Domestic Engineering.



Metropolitan Supply Co.

Manufacturers and Dealers in

Plumbers' Specialties
Plumbers' and Steam Fitters' Supplies

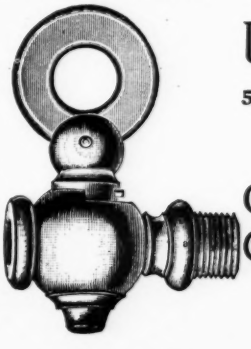
511 Grand Street, New York City

Telephone 2405 Franklin

Plumbers can save time and money by using our Nickel Plated Flush Pipe Elbow

The best pump in the world cannot lift water from a dry well, but there is water down lower and a dry time is the best time to dig for it.

Balls, Bodies, Binding Posts, Bushings, Caps, Cocks, Nozzles, Gas Stove Fittings, Nipples, Swings, Screws, Nuts, Wire Connectors Electrical Goods, Etc., Etc. SPECIAL TURNING TO ORDER.



United Metal Mfg. Co.

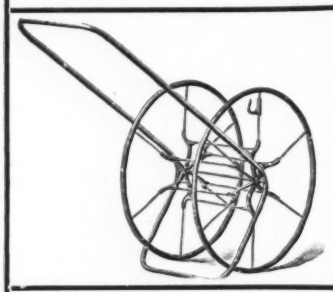
525-527 Broome Street, New York

Manufacturers of

Gas, Electric and Combination Fittings

FROM BAR METAL

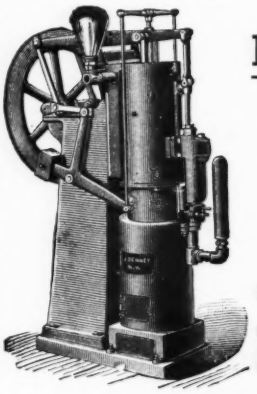
WIRT'S ALL IRON HOSE REELS



Are cheaper than Wooden Reels. They look better, last longer and give better satisfaction. They are the best for all purposes. Wirt's Wall Reels and Hump Racks for fire protection.

Wirt & Knox Mfg. Co.
219 N. Third St.
PHILADELPHIA, PA.

Our Discounts are Liberal



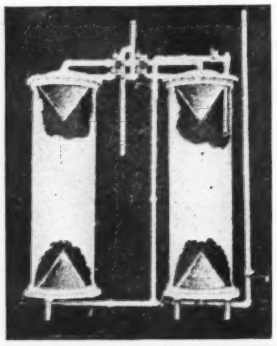
Denney Improved
Rider and Ericsson
Hot Air Pumping Engines

Embody the very latest Improvements in Design and Construction.
The Most Reliable and Economical Engines for Pumping water.
Use any kind of fuel.
Can be operated by anyone.

Perfectly Safe, Noiseless,
Ever ready for Service

Built for years by
American Machine Co. WILMINGTON, DELAWARE
Agents Wanted in the West.

THE ECLIPSE DUPLEX FILTER



Easily and thoroughly cleaned with Filtered Water.

No Alum or Coagulent used for Clarifying

Send for catalogue and hundreds of references on the best filter made in the U. S.

ECLIPSE FILTER CO.
Philadelphia Bourse

Send for Catalogue.

RELIABLE TINNERS' FURNACE

MADE BY

The SCHNEIDER-TRENKAMP Co., Cleveland, Ohio.

BILLINGS PIPE BENDERS

Patented Sept. 24th, 1889.
SAVES TEN TIMES ITS COST EVERY MONTH.

This device is a **Specially Shaped Spiral Spring**, made from **Crucible Steel** wound tapering to one end so as to be easily withdrawn, and having a loop at the other to hook into when the bend is to be made in a long piece of pipe.

The Bender, placed inside of the pipe, supports and prevents the pipe from flattening or collapsing while being bent. By the use of it lead pipe, and copper, brass or steel seamless tubing may be quickly and easily bent. It is as easy to form opposite or double curves, such as goose necks, as a single bend.

THE BILLINGS PIPE BENDER MFG. CO.
38 Park Place and 33 Barclay St., NEW YORK CITY

The McGuire Adjustable
ROOF FLANGE

No. 1. will adjust from ¼ pitch to ½ pitch
No. 2. will adjust from flat to ⅓ pitch

Made for Standard and Extra Heavy Pipe in copper and Galvanized Iron. Only two sizes to be carried in stock as the adjustments fit all angles.

For Prices, etc., apply to

KENDRICK VALVE AND WASHER COMPANY,
SYRACUSE, N. Y.

The above cut shows our No. 1, ¼ to ½ pitch

WE CAN SAVE YOU MONEY

Cooper's Adjustable Drain Trap

Has a 4-inch Seal and is an absolute protection against Sewer Gas. $1.75 to $2.00 SAVED ON EACH TRAP. Write and we will show you how to make money.

Libbey, Parker & Co., = Boston
Sales Agents for Libbey Drip Valve, Victor Ball Cock and Victor Brass Pipe Hanger.

SOMETHING NEW

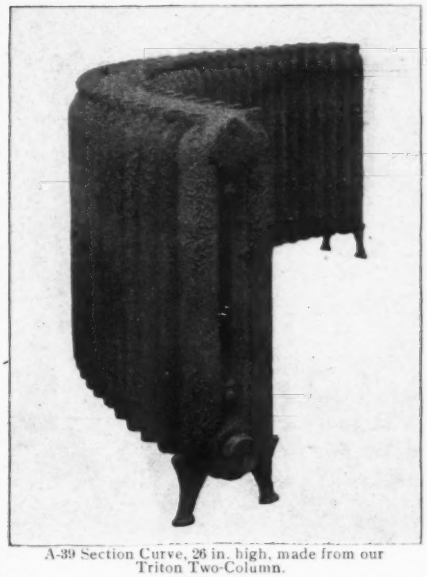
Vanderman's Adjustable Fitting for Connecting Soil Pipe

Send for Catalogue and Price List of Plumbing and Heating Specialties, or order through your Jobber.

Freight allowed on the Adjustable Fittings, East of the Mississippi river, on a dozen of one or assorted sizes.

MANUFACTURED AND FOR SALE BY

THE VANDERMAN PLUMBING AND HEATING COMPANY
Willimantic, Conn.



A-39 Section Curve, 26 in. high, made from our Triton Two-Column.

NEW YORK WAREHOUSE,
10th & Henderson Sts.
Jersey City, N. J.
Telephone 171 Jersey.

OUR HANDSOME NEW PATTERN

THE
Triton Two-Column

is now ready for delivery. We can furnish it in all heights for either Steam or Hot Water. We also manufacture this

Same design and decoration in

Our Three and Four Column Radiators

All heights, for Steam or Water

United States Radiator Co.

Dunkirk, N. Y.

Why not Save Your Brain

Don't spend hours figuring results which can be learned at a glance from

BELDEN'S NEW DISCOUNT TABLES

Table 1 shows costs in discounts (also nets), with discounts to sell by to yield a profit of 10, 15, 20, 25 or 30 per cent on the **selling price.**

Table 2 shows costs in discounts (also nets) with discounts to sell by to yield a profit of 10, 15, 20, 25 or 30 per cent on the **cost price.**

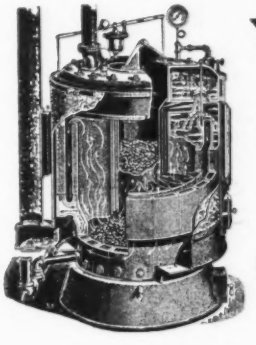
The discounts consist of over 100 "split" combinations from 10 and 10 per cent up to 85 per cent—a range sufficient for any usual practical use.

Table 3 gives equivalents and nets of all combinations of discounts from 25 per cent to 82½.

(This is the same table published in our **Jobbers' Directory,** and added here to complete a series which will be found very great time savers.)

Conveniently bound in pocket form.
Sent postpaid for $1.00.

DOMESTIC ENGINEERING
CHICAGO.



YOU KNOW

How coal is wasted up a flue. We guarantee the **"ROBERTS"** to be the most economical and easily managed boiler on the market. Will not such a boiler get you further orders?

Philadelphia Office:
Builders' Exchange,
18 South 7th Street

Roberts Machine Company
Collegeville, Pa.

Eminent chemists testify that our Water Filters are germ proof. No chemicals used; Filters can be thoroughly cleansed without removing any part.....
....Results guaranteed....

CAPACITY
10 to 10,000 gals. per hr.

Hundreds of our customers have furnished voluntary testimonials.

LIBERAL DISCOUNTS TO PLUMBERS.

Catalogue Mailed on Application.

WM. B. SCAIFE & SONS.
PITTSBURGA, PA.

"THE DEWEY"

OUR
LATEST
SUCCESS IN
LOW-DOWN
SYPHON
JETS

THE
CONQUEROR
OF ALL
LOW-DOWN
COMBINATIONS

MADE BY

BELL MFG. COMPANY

70-78 Fulton Street

Telephone 1033 John

NEW YORK, N. Y.

Announcement

WITH considerable pleasure we present to the trade our annual Christmas issue and with it our heartiest greetings.

We have endeavored to make this issue as attractive as its predecessors, and we have published a very large edition; but we have solicited no extra advertising, believing our customers would appreciate that course more than they would an invitation to purchase extra advertising space at a high price.

To our employes, whose cheerful and intelligent co-operation makes the production of such a publication from our own plant possible, we extend our thanks. To our many advertisers, more in number than are found in any other paper in the world devoted to plumbing and heating, we extend our thanks for their generous and continued support. To our subscribers, who have never increased in numbers so rapidly as in the year just closing, we extend our thanks for their magnificent patronage, for they form the foundation upon which the success of this journal is built. We shall strive during 1901 to raise still higher the character of our journals.

Domestic Engineering

JNO. K. ALLEN, Editor.

IF YOU KNEW

how good the **Tyden Filter** is, in connection with hydrant-supply, you would be using one now, yourself, and no sooner part with it than with your bathtub. You would also be putting them up in nice modern homes and making money on them at a lively rate. It's a good thing—the best article for the purpose and practical. Patented in U.S. and foreign countries. Send for our illustrated booklet, mailed free.

METROPOLITAN FILTER COMPANY
97 WASHINGTON ST., CHICAGO.

REDFIELD'S Wrought Steel Hose Clamps
Strong, Light and Pliable, Perfect Inner Circle Will not leak
MANUFACTURED BY
J. R. CLANCY,
SYRACUSE, N. Y.

VALVES

of many kinds for many purposes, but all

GOOD

Our Catalogue will tell you

HERMANCE VALVE Co.
SYRACUSE, N. Y.

Sisson Insertable Joint
Indispensable to Plumbers
A friend in need is a friend indeed.
THE S. I. J.
FOR SOIL PIPE
Sizes 2 to 6 inches. Light and Heavy.
Makes a neat job and saves your patience.
ASK YOUR JOBBERS FOR IT

This does the trick.
MANUFACTURED BY
R. ESTABROOK'S SONS
SOUTH BOSTON, MASS

M'VAY & WALKER.
Manufacturers of Enameled Tubs.

WILL GLADLY SEND PRICES ON THE TWO BEST TUBS MADE.

Write Today. Unique and Eureka Prices will surprise you.

BRADDOCK, PA.

PLUMBERS' LEAD TRAPS

There are some pretty good reasons why plumbers should use The Western Brass Mfg. Company's Lead Traps, Bends and Ferrules, and why jobbers should handle them. Those who use and handle them know the reasons. Those who don't ought to. Better write right now.

The Western Brass Manufacturing Co.
615-617 WALNUT STREET, ST. LOUIS, MO.

THE WILHELMI | THE MODERN

two best boilers

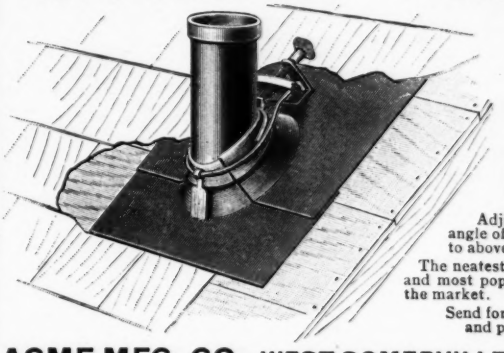
The "Wilhelmi" is a high grade copper range boiler tested to 250 lbs. There can be no better boiler made : : : : : :

The "Modern" is for use where the pressure does not exceed 100 lbs. It is guaranteed against collapse : : : : :

Very attractive discounts furnished

Hayes Mfg. Co., Paterson, N. J.

HAVE YOU SEEN IT WORK? IT IS A MARVEL.



Two-Part Acme Roof Flange

Adjustable to any angle of roof from flat to above 45 degrees.

The neatest, most unique and most popular flange on the market.

Send for catalog and prices.

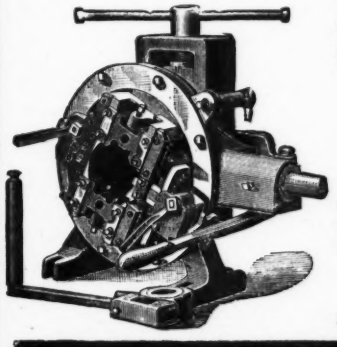
ACME MFG. CO., WEST SOMERVILLE, MASS.

MINUTES COUNT

When you have a "Rush" job on hand' tis then the virtues of

ARMSTRONG
WATER, STEAM AND GAS FITTERS
TOOLS

make themselves apparent.



They are made especially for Time and Labor—Saving and for Extensive Wear.

PIPE THREADING and CUTTING OFF MACHINES
HAND or POWER
capacity from 1-4 in. to 6 in.

PIPE WRENCHES
VISES
ADJUSTABLE STOCKS and DIES

Send for Catalogue

THE ARMSTRONG MFG CO
BRIDGEPORT, CONN., U.S.A.
NEW YORK 139 CENTRE ST.

T.P.A.A.163

THE VERY BEST BALL COCK

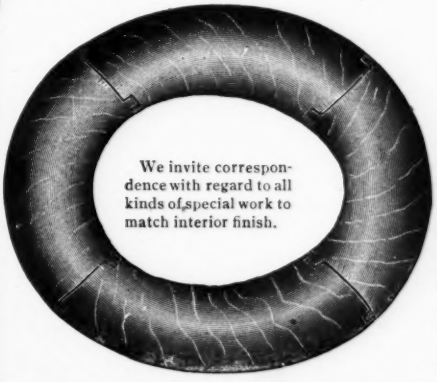
For High Pressure.

Has reversible seat made of Bronze Metal.

For sale by dealers in supplies. Correspondence Solicited.

Patented.

THE BIRKERY MFG. CO., HARTFORD, CONN.



We invite correspondence with regard to all kinds of special work to match interior finish.

THE BEST PLUMBERS' WOODWORK MADE.

We make special orders in all fancy woods, such as Mahogany, Bird's Eye Maple, Sycamore, Black Walnut, etc.

We make drain boards in a superior manner, and invite sample orders.

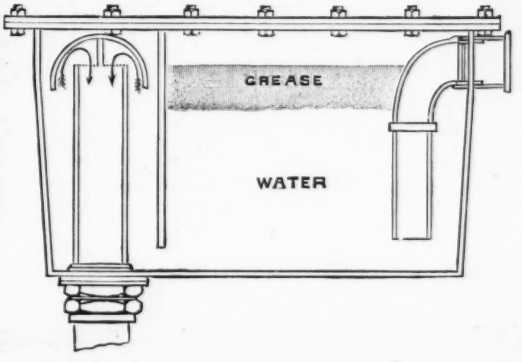
H.B. Olmstead & Co.
87 Frankfort Street
NEW YORK CITY

Only Mechanical Grease Trap

on the Market that will catch every ounce of grease

Only Grease Trap that can be easily taken apart and thoroughly cleaned.

Only Grease Trap containing an inside trap for quick action and removing of contents when desired. Connecting pipes may be increased or reduced from 1½ to 4 inches. Many other superior points will be advanced upon request.



Write for particulars

JAMES BARRETT & SON
48-50 Pearl Street and 209-211 Franklin Street
BOSTON, MASS.

BELL MFG. CO.

MANUFACTURERS OF
STEEL CLAD AND GALVANIZED
STEEL ENAMELED

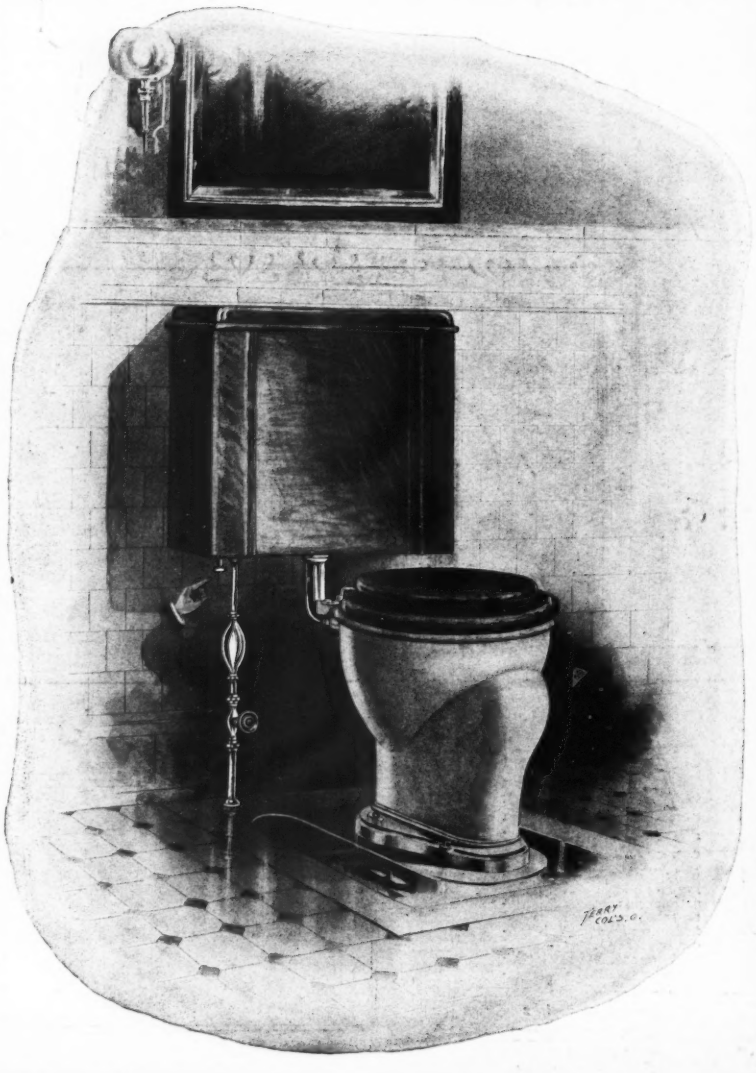
BATH TUBS

281 WATER ST., NEW YORK

PLUMBERS' FINE WOOD WORK, LOW DOWN TANK COMBINATIONS, FLUSH AND SUPPLY PIPES

OUR WEEKLY

THE only weekly newspaper in the trade; prompt, complete and reliable. If you have our monthly for technical information, you should have this for news.



A GOOD RULE

Be sure that you are getting the **GREATEST VALUE** for your money.

Half the Profit is in the Buying.

We GUARANTEE that every customer will find Better Value in our Low Tank Combinations than is obtainable anywhere else at so low a price as we name. If after the severest inspection and comparison with others, it does not prove such, it may be returned at our expence.

WHAT COULD BE MORE FAIR?

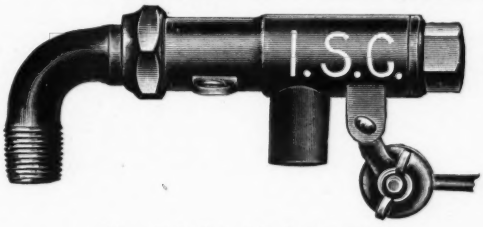
The Columbus Brass Company,

COLUMBUS, OHIO.

Prices and Information upon Application.

THE I. S. C. BALL-COCK

FOR HIGH OR LOW PRESSURE.



Guaranteed for any pressure.

SEND SAMPLE ORDER.

Sizes ½ inch to 4 inches in stock.

CURTIS
ENGINEERING SPECIALTIES

WATER PRESSURE
REGULATOR
FOR DWELLINGS, HOTELS, ETC.

SEND FOR CATALOGUE.

JULIAN D'ESTE COMPANY
24 CANAL STREET, BOSTON, MASS.

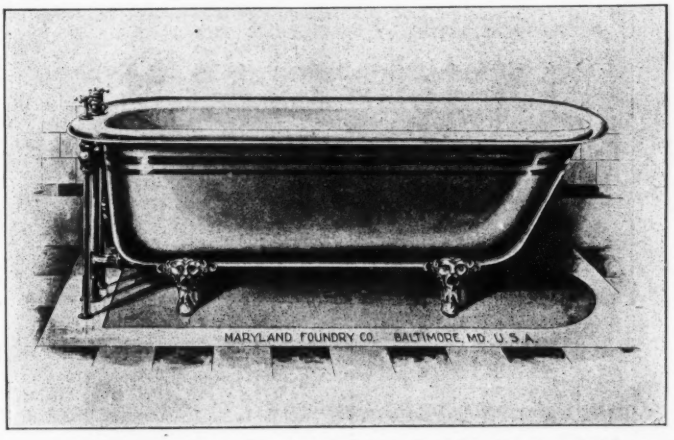
TANKS AND SEATS

IN ANY WOOD

HERMANN FURNITURE AND PLUMBERS' CABINET WORKS
368-70 Broome Street NEW YORK CITY

Up to Date Finish

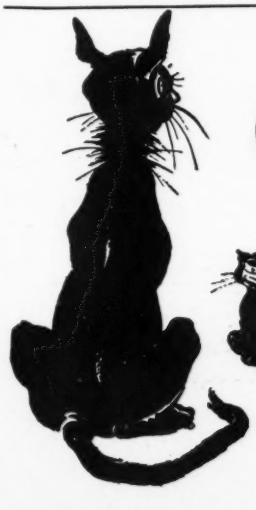
TRY OUR GOLDEN OAK FINISH



The "Countess"

Pattern Maryland Enameled Bath is but one of the elegant line of baths made by us for the trade who desire particularly fine goods at the same price as other companies charge for run of foundry goods. Our catalogue shows other styles.

A. Weiskittel & Son
BALTIMORE, MD.



WHEN LOOKING FOR HIGH GRADE

CLOSET COMBINATIONS

AT REASONABLE PRICES, WRITE TO

FLECK BROS.
44 N. Fifth Street Philadelphia, Pa.

FULL LINE OF
FINE PLUMBING GOODS

Accessible Sewer Flushing Fittings.

Flushing Clean-out Trap.

Four Way Cleanout and Branch.

Straightway Backwater Gate.

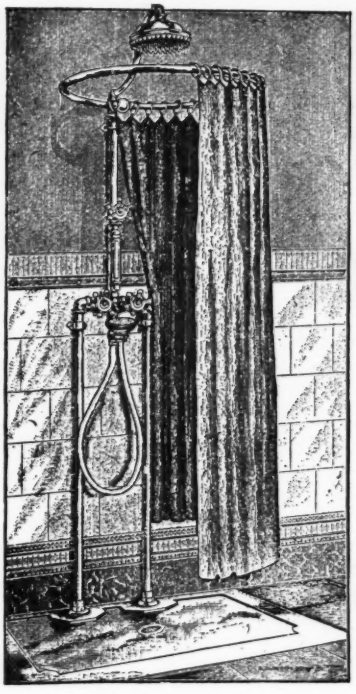
Resist sewer or backwater pressure; location of sewers always known and accessible without disturbing floors or concrete; each fitting has iron inspection manhole to surface, with tight but removable cover; flushed by hose or may be connected to main water supply.

Made for either iron or clay pipes. Backwater gates may be attached preventing flooding of cellars. Can you imagine anything better?

CATALOGUE FREE

Iron Sanitary Mfg. Co.,
52-54 Dearborn Street
CHICAGO, ILL.

SHAMPOO "Shower Baths"



Special prices to the trade on Shower and Needle Baths and Shampoo Fixtures in a large variety of our own manufacture.

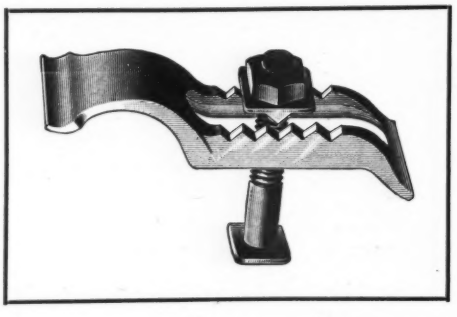
Write for catalogue

Street & Kent Manfg. Company
109 S. Jefferson St.
CHICAGO

Also manufacturers of an extensive line of special designs in brass work for lavatories, bath tubs, sinks, etc. Brass work in a large variety for marble and slate closet and urinal stalls.

THE GENUINE

Never "Slip" Basin Clamp



Is made of bronze and not yellow cast brass
Enough said!

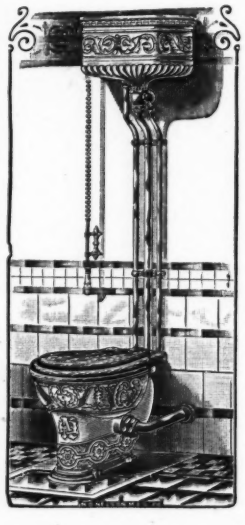
Manufactured only by

Wolverine Brass Works

Grand Rapids, Mich.

AVOID CHEAP IMITATIONS

PLUMBERS' SUPPLIES



Nelson Syphonia Water Closet

Pneumatic syphon

PRICE REDUCED
QUALITY RAISED

N. O. NELSON MFG. CO., SAINT LOUIS

You May Need Your Money!!!

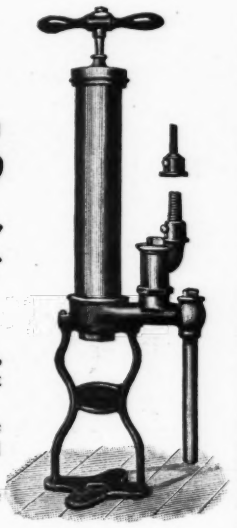
Don't buy 3 Pumps when one will do the work.

THE

PERKES

Patent Combination Air, Force and Test Pump.

Patented March 15, 1898.



Wil test soil pipe, prove gas pipe, and there is no force pump made that is its equal.

No stuffing boxes; all valves are on the outside and work equally well with air or water.

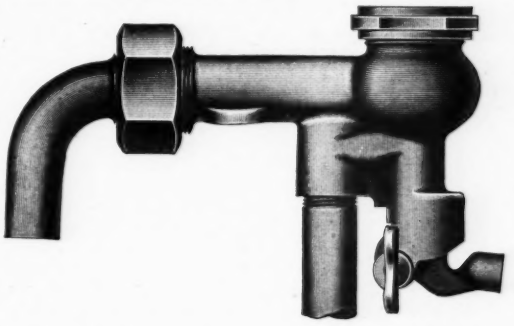
Our circular will tell you of the other good points.

CHARLES PERKES

MANUFACTURER

Established 1856 627-629 Arch St., PHILADELPHIA

The Problem Solved



The Duplex Ball Cock

GUARANTEED TO OPERATE ON ANY PRESSURE FROM ONE POUND TO THREE HUNDRED POUNDS. MADE FOR TOP, BOTTOM AND END SUPPLY. FOURTEEN SIZES AND STYLES.

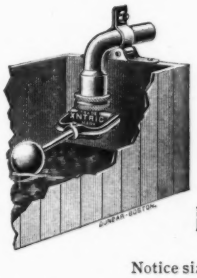
A Postal will bring you Price List and Discounts

F. W. WEBB MFG. CO.

52 to 60 Elm Street, 2 to 24 Friend Street, BOSTON, MASS.

YOU WANT THIS!

As you have been looking for it these many years.



The Xntric Ball Cock

For High or Low Pressure

Notice size of Ball. It is only 3½ inches

Practically noiseless. Guaranteed for two years. There is positively no hammering, and the only one on the market where the valve is closed by water pressure, and which obviates all danger of accident. Been on the market and heartily approved for three years. For use with hot or cold water.

SEND POSTAL FOR FLYER TO

Xntric Valve Co.

36 Columbus Ave. Boston, Mass.

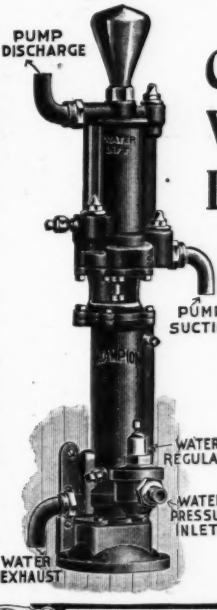
In use in Massachussetts State House and United States Postoffice, Boston.

THE CHAMPION WATER LIFT

IT PAYS

TO PUT IN THE

CHAMPION WATER LIFT



For pumping cistern water or for increasing city pressure it is the BEST.

IT WORKS PERFECTLY.

That is our guarantee, and our name is guarantee that the construction is right. Handled by all large jobbers. Write for catalog.

MADE ONLY BY

THE CLEVELAND FAUCET COMPANY

CLEVELAND: 15-27 Frankfort Street.
NEW YORK: 4 Great Jones Street.
CHICAGO: 92 Franklin Street.
SAN FRANCISCO: 202 Ellis Street.

THE CHAMPION WATER LIFT

All first class Plumbers
are using the
New Style
Broughton Self Closing
Basin Cock
NO EXPOSED SURFACES, EASILY KEPT CLEAN
THE BROUGHTON SELF-CLOSING BIBBS & COCKS HAVE BEEN ON THE MARKET SEVERAL YEARS - SUPERIOR TO ALL OTHERS FOR SIMPLICITY AND STRENGTH - EVERY ONE WARRANTED.
Send for Circular
and Price List
E. STEBBINS MFG. CO.
SPRINGFIELD MASS.

Did you ever hear of the LYONS' COCKS? Why, of course you did. Everybody is using them now.

You can change 'em around, or use any kind of a handle. If you haven't used them, you don't know how good they are.

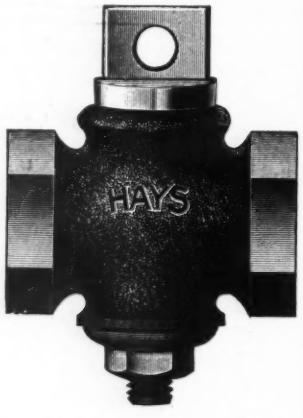
THEY ARE MADE OF ENTIRELY NEW, TOUGH METAL

WE DON'T NEED TO SAY THAT THEY NEVER LEAK BECAUSE THEY NEVER DO.

CLEVELAND BRONZE & BRASS WORKS

SOLE MANUFACTURERS, CLEVELAND, O

Buying Gas Goods Now ?



HERE IS A LIST OF OUR LINE

Gas Service, Meter and Union Meter Cocks: both Standard and Heavy Patterns. Plain and Hexagon Head Kittaning Mixers, Set Screw and Globe Mixers; Lock Shield, Square Stem and Wheel Valves.

Gas Goods that will Give Satisfaction

Hays Mfg. Company

ERIE, PA.

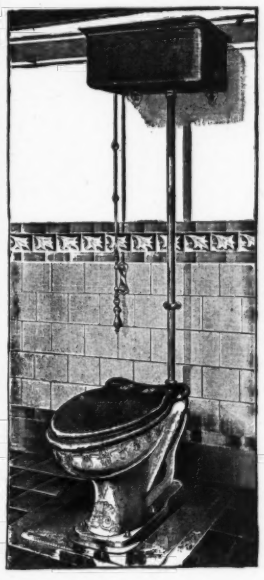
J. B. CAMPBELL

Brass Works

Brass and Iron Goods for Water and Gas Connections. Plumbers' Supplies.

Office and Works: 16th and Cameron Sts

Erie, Pa.



—THE—

ORINOCO Syphon Jet Closet.

This Orinoco Syphon Jet Closet is what you should have. This is the most perfect and noiseless closet now manufactured. The workmanship and High Grade Finish of the Orinoco Closet cannot be excelled.

IT SPEAKS FOR ITSELF TRY ONE AND BE CONVINCED.

MANUFACTURED BY

THE KING MFG. CO.

LIMITED.

205 Wood Street, Pittsburgh, Pa.

THE REX.

THE KING

of them all.

Syphon Hopper and Trap Combined.

Surpassed by no Closet on the Market.

This closet has **full water ways** through all the **syphon pipes, a large water surface** and 3 inch Seal. It is made for high or low tank . Embossed or plain surface.

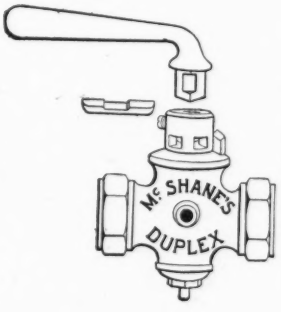
Earthenware Specialties designed and finished with unsurpassed art and workmanship.

The Sanitary Earthenware Specialty Company

Trenton, N. J.

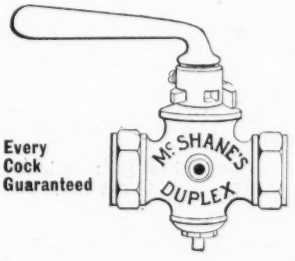
THE

"Duplex" Stop Cock



One of Simplest Cocks on the Market To-day

The above shows how easily the Cock can be taken apart and made either Right or Left hand as desired.



Every Cock Guaranteed

They are made of best metal and thoroughly ground

Each Cock is tested before leaving the factory

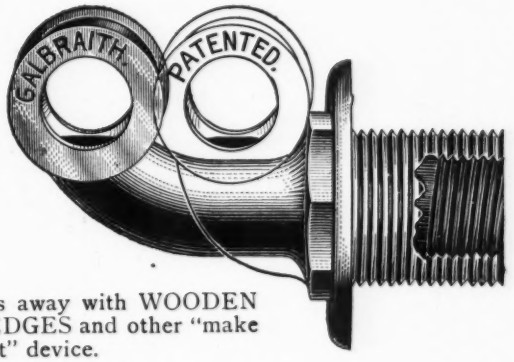
Manufactured only by

Henry McShane Mfg. Co.

BALTIMORE, MD.

WHY! EH! WHY!

BECAUSE



IT does away with WOODEN WEDGES and other "make shift" device.

IS NON-TRAPABLE,

IS especially adapted for wash trays having opening for faucets very close to top of tub.

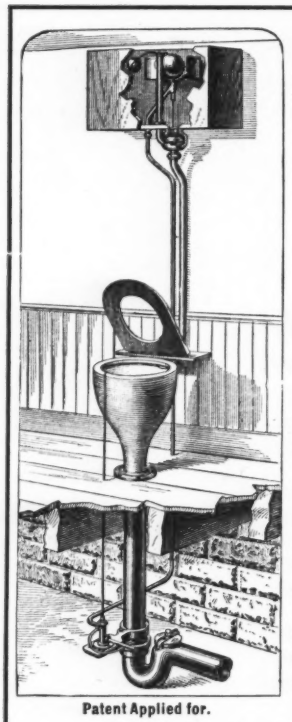
IT prevents sediment collecting in wash tray supplies.

YES we make them in brass and galvanized iron.

IT it is used by economical plumbers everywhere.

IS kept in stock by leading supply houses.

Galbraith & Co., Plainfield, N. J.



Patent Applied for.

The Walls & Pearsall

Anti-Freezing Closet

For Outside Locations

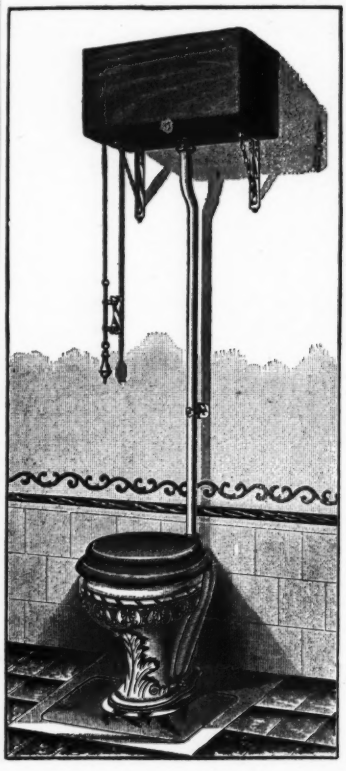
Can be used where other closets would freeze. Perfectly frost proof in zero weather.

The tank contains no ball or cock washers, has no chain or pull, is simple in construction, cheap and durable. No water above frost line. An automatic flush after each using.

A small quantity of water is discharged before each using, in order to keep Hopper damp and prevent any substance adhering.

WALLS & PEARSALL

305-307 N. Twelfth St. PHILADELPHIA, PA.



The "Diamond" Siphon Jet Water Closet

WITH ROLL RIM

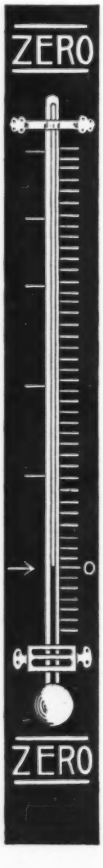
A Beautiful, Clean and Durable Sanitary Fixture

McClellan Anti-Siphon Trap Vent

Lead Pipe, Lead Traps and all kinds of Plumbers' Materials

F. N. DU BOIS

243-247 Ninth Ave.
NEW YORK



Zero Quick Wasting Hydrant,
Zero Jr. Hydrant,
Zero Self-Closing Hydrant.

Large Wastes, Quick Action, Non-Freezing. Cheapest and best Hydrants in the world.

Zero Brass & Valve Mfg. Co.

BUFFALO, N. Y.

COLT TRADE MARK.

CARBIDE FEED ACETYLENE GAS GENERATORS

Indorsed by the United States Government. The Department of Agriculture of the State of Pennsylvania says: "Safer than the usual employment of petroleum."

Entirely new principles involved. Made of the best materials, by the most expert mechanics. Guaranteed by the largest and most experienced concern in the business.

The COLT TRADE MARK Generators, are lower in price, more economical, and more easily installed and operated than any other make, and occupy one-quarter of the space.

No waste of gas; no heating. This is not true of other makes.

J. B. COLT CO.

DEPT. R

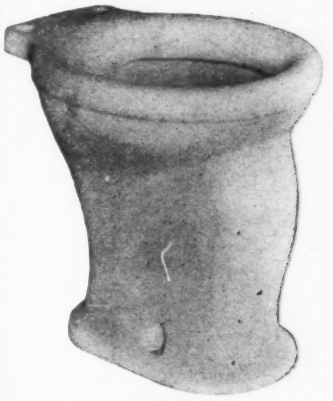
408 EAST 32D ST. NEW YORK, N. Y.

421 Chestnut Street, Philadelphia, Pa.
146 Franklin St., Boston, Mass. 189 La Salle St., Chicago, Ill.

To the Plumbing Supply Trade:

Cut No. 1. represents our new improved plain wash down, which is made with walls one inch thick insuring unusual strength, thereby reducing liability of breakage to a minimum; it is therefore particularly adapted for public buildings, schools or any public place where closets are subjected to hard usage, and is designed to take the place of imported or domestic fire clay closets, and being constructed of a hard vitreous china body it is guaranteed against crazing.

We can also furnish these closets with syphonic action or syphon jet.



No. 1. Plain Washdown

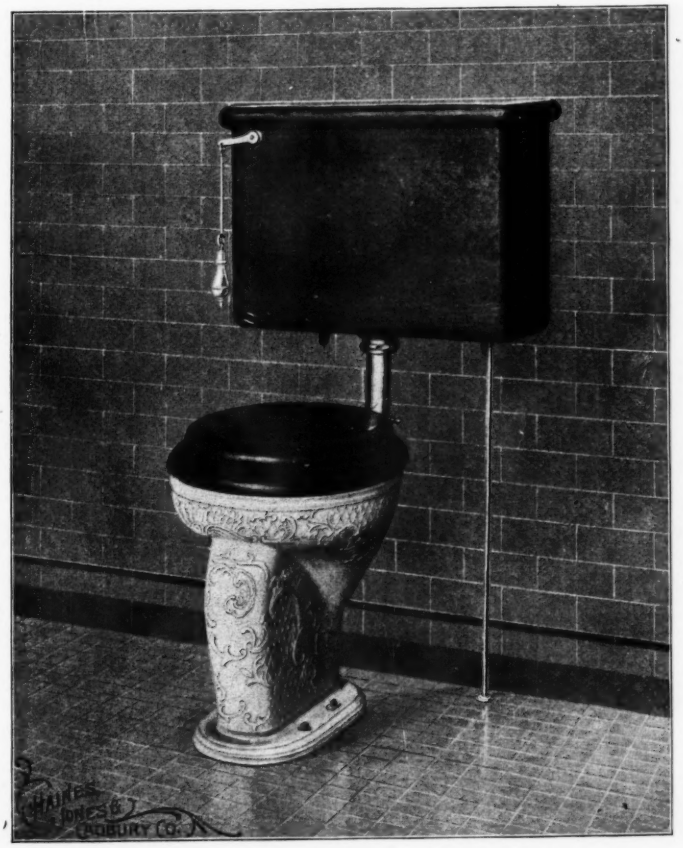
No. 2. Syphon Jet Hopper and Trap

Cut No. 2. represents our syphon action or syphon jet hopper and trap, made also in vitreous china and guaranteed against crazing. It is made with the standard 5 1-2 inch seat attachment and can be used to replace any of the the regular closets on the market.

We manufacture everything in the sanitary earthenware line and pay particular attention to specialties. All closets being tested before leaving our works, we guarantee their working qualities.

Bellmark Pottery Co.,

P. O. Box 547. TRENTON, N. J.



The

"Sedate"

We Handle all grades of Low Down Tank outfits, including syphon jet, syphoning hoppers with jets and plain hopper and trap combinations.

We Manufacture the "QUIET" syphon jet and the "SEDATE" syphoning hopper outfits and recommend them to all who desire a thoroughly high grade and highly perfected outfit.

The TANKS, seats and lids are made from carefully selected hard woods, which are highly finished. The "Quiet" and "Sedate" tanks have heavy tinned copper linings and all seams are locked and carefully soldered.

Haines, Jones & Cadbury Company

1128-44 Ridge Avenue
1423 Chestnut Street

Philadelphia, Pa.

Jobbers' and Manufacturers' DIRECTORY

For Nineteen Hundred and One

Our Jobbers' and Manufacturers' Directory for 1901 is now being printed and will be ready for delivery early in January. Orders will now be received.

Price, Delivered $5.00

The book will be more usable than ever before, as the jobbers of plumbing material are listed separately from those handling heating and mill supplies.

Domestic Engineering
58-64 North Jefferson Street, Chicago

STANDARD BATHS

We believe every plumber and dealer should carefully consider the trade-winning qualities of the line of enameled goods which he carries.

The product of the four leading concerns, composing this company has the reputation of being the best in the world.

These four concerns are:

The Standard Manufacturing Co., Pittsburg.
The Ahrens & Ott Company, Louisville.
Dawes & Myler Works, New Brighton.
Buick & Sherwood Mfg. Co., Detroit.

The high reputation for beauty and durability which these goods have gained has created a strong and permanent demand for them the world over.

The best line of goods for the dealer to handle is that for which there is the greatest demand.

Free catalogues may be obtained at the home office or any of our branch houses.

The Standard Sanitary Mfg. Co.

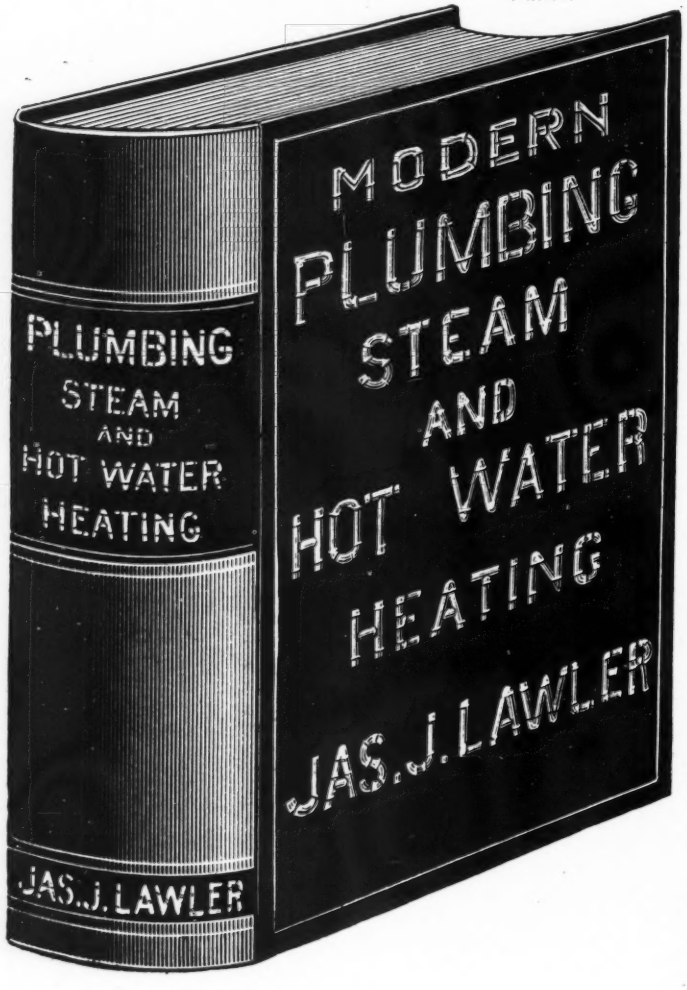
Pittsburg, Pa.

BRANCH OFFICES:
New York, Philadelphia, Buffalo
Cleveland, Chicago, Montreal

FACTORIES:
Pittsburg, Pa. Louisville, Ky. New Brighton, Pa.
Detroit, Mich. Ellwood City, Pa.

CHARLES AUSTIN BATES N Y

LATEST AND BEST



In Plumbing

It explains soil and waste pipe ventilation, back venting, the house trap, the fresh air inlet and their advantages. Siphonage of traps, the cause and how to remedy the same. How to test soil and waste pipes. Probable questions of plumbing examining boards, and answers to same. Hydraulics of plumbing, with original illustrations. Practical drawings and all important features in the construction of modern plumbing work.

In Heating

It tells how to correctly figure on any size or shape of building with steam or hot water. How to find the heating capacity of any shape or make of boiler for steam or hot water heating. The most practical timesaving tables ever compiled and published. A new table of how to quickly find the correct measurement of 45° angles, a most useful thing in steam and hot water construction. This has never before appeared in print.

More practical illustrations than ever published in any one volume, which shows the various systems of construction, in the heating and ventilating of buildings by the steam or hot water systems.

Over three hundred diagrams and illustrations, showing the various systems of construction in the heating and ventilating by steam or hot water systems. Six folding inserts showing waste pipe system of plumbing, one pipe system of both steam and hot water heating, overhead system, fan system of heating and ventilation, and steam and hot water circuits. 400 pages, large octavo size, 10x7½ inches. Bound in extra cloth.

Price, $5.00

DOMESTIC ENGINEERING, 58-64 N. Jefferson Street, CHICAGO

THE "GEGENSTROM"

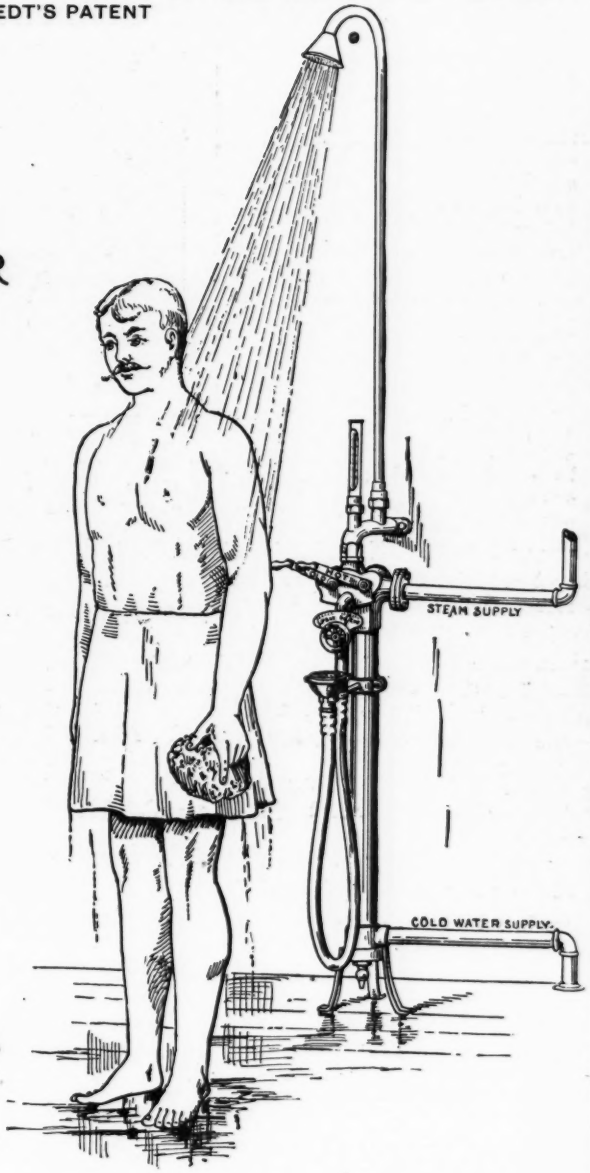
HOT WATER APPARATUS

SCHAFFSTAEDT'S PATENT

FOR THE INSTANTANEOUS
PRODUCTION OF

WARM OR HOT WATER

BY MEANS OF STEAM.



ESPECIALLY ADAPTED FOR

RAIN BATHS

IN INSTITUTIONS,
REFORMATORIES
AND PRISONS,
IN HOSPITALS,
INSANE ASYLUMS,
GYMNASIUMS,
ARMORIES
AND IN
PEOPLE'S BATH ESTABLISHMENTS.

RUNDLE-SPENCE MANUFACTURING COMPANY

THE PEOPLE WHO DESIGN AND MAKE MODERN AND RELIABLE
PLUMBING FIXTURES. (THE GUARANTEED KIND.)

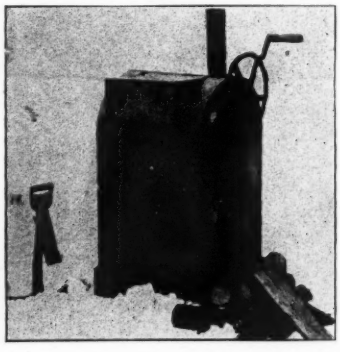
89-91 WISCONSIN STREET
63-67 SECOND STREET
MILWAUKEE

WESTERN AGENTS

52 DEARBORN STREET
CHICAGO

"A Warm Thing"

For PLUMBERS, EXCAVATING CONTRACTORS, GAS and WATER COMPANIES and others whose work necessitates digging in FROZEN EARTH or cutting through ASPHALT PAVEMENTS



The "Klondike Hot Blast Thawer"

will be found an ECONOMICAL and SERVICEABLE tool for thawing frozen ground and softening asphalt. For thawing, it beats the open fire as the Arc Light does the tallow dip, and for cutting through asphalt, it makes it easier to use the shovel than the ax. A BOY can operate it, and two of them can carry it. The same fuel used on the open fire, but less of it, is all that is required.

The construction is of sheet steel with Asbestos interlining. RADIATION is reduced to a minimum and a maximum of heat is applied where wanted.

For introduction ONLY we propose to sell a single one in each city for $20.00 on board cars at factory—2-3 the regular price—and this offer is only good until February 1, 1901.

ALASKA SUPPLY & AGENCY COMPANY,

SIOUX CITY, IOWA.

Read the Following Testimonials.

Office of
NOBLE & DURKIN
PLUMBERS
HEATING AND VENTILATING ENGINEERS

SIOUX CITY, IOWA, March 30, 1899

ALASKA SUPPLY & AGENCY CO., SIOUX CITY, IOWA.

GENTLEMEN:—We have used your Alaska thawing apparatus, in excavating frozen ground, also to soften asphalt pavement and found it greatly facilitated the digging, doing away with the tedious picking and chopping. After 15 to 20 minutes operating the machine, we could shovel out frozen ground or asphalt to a depth of 8 inches.

Respectfully yours,
NOBLE & DURKIN

TESTIMONIAL NO. 2.

CITY OF SIOUX CITY.

Board of Trustees of Water Works.
G. B. HEALY, President
W. P. BARKER
J. P. ALLISON, Secretary

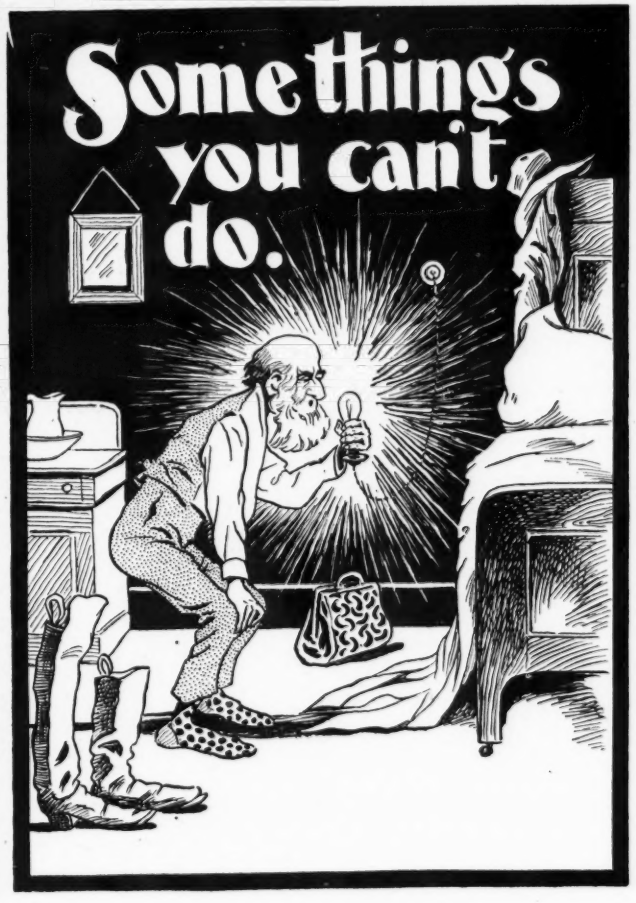
E. B. SPAULDING.
Superintendent

SIOUX CITY, IOWA, March 21,

ALASKA SUPPLY & AGENCY CO., SIOUX CITY, IA.,

GENTLEMEN:—I take pleasure to state that during the cold weather we had last month I had occasion to use one of your thawing devices in the performance of my duties as an employee of the City Water Works, and used it in going through asphalt pavement, concrete and frozen ground underneath. While the occasion was not such as required a thorough test, I can say that it performed its work readily and effectively and with no other fuel than box lumber. I have been in the City Water Office for several years, both as Superintendent and employee, and have never found a better or more efficient article for use in cutting through asphalt pavement or frozen ground, and can cordially recommend it for such purposes.

Yours Respectfully,
PHIL. CARLIN



You cannot sell stop cocks that you have not got.

You cannot sell other stop cocks than those made by the Glauber Manufacturing Company with justice to yourself and satisfaction to your customer.

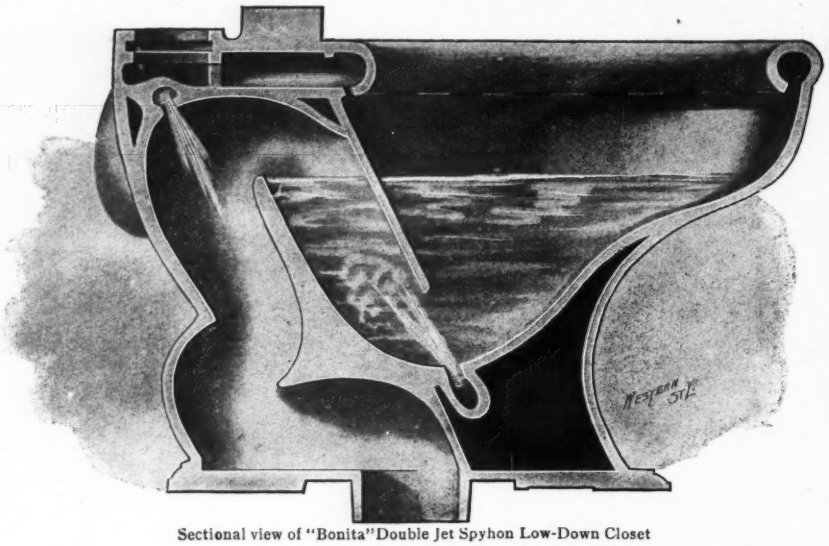
You cannot do the business you might nor make the impression you ought if you try to sell any other stop cock claimed to be just as good.

There are no stop cocks as good as the Glauber.

You can sell more of them and make more money on them than on any other goods, but you cannot do it until you get them.

Our catalogue will tell you all about them.

GLAUBER BRASS MANUFACTURING CO., CLEVELAND, OHIO



Sectional view of "Bonita" Double Jet Syphon Low-Down Closet

Rumsey's "Bonita"

Double Jet Low-Down Syphon Closet

The cut at the top of this page shows a sectional view of our "Bonita" closet, as designed and patented, for low-down use. The objections heretofore in low-down closets have been the inefficiency of the syphoning, because of the lack of pressure, caused by placing the tank so near the closet. The difficulty is overcome in our new closet by adding a downward jet into the discharge leg of the closet, thus driving the air out of the discharge leg of the closet and removing the resistance to the upward jet. The downward jet is effectively trapped to prevent gases passing through same and through the flushing rim into the room.

We recommend this closet to architects and plumbers as a perfect working and sanitary closet.

L. M. Rumsey Mfg. Co.

810 North Second St. ST. LOUIS, MO.

Rumsey's "Bonita" Double Jet Syphon Low-Down Closet with Porcelain Tank

SUPPLIES AND TOOLS FOR Plumbers GAS & STEAM Fitters.

THE JAMES ROBERTSON MANUFACTURING CO.
MANUFACTURERS

FACTORY
827 S. HOWARD ST.
OFFICE AND STORE
30 HANOVER ST.
BALTIMORE.

LEAD TRAPS	ENAMELED BATH TUBS
LEAD BENDS	LAVATORIES
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SHEET LEAD	SANITARY WATER CLOSETS
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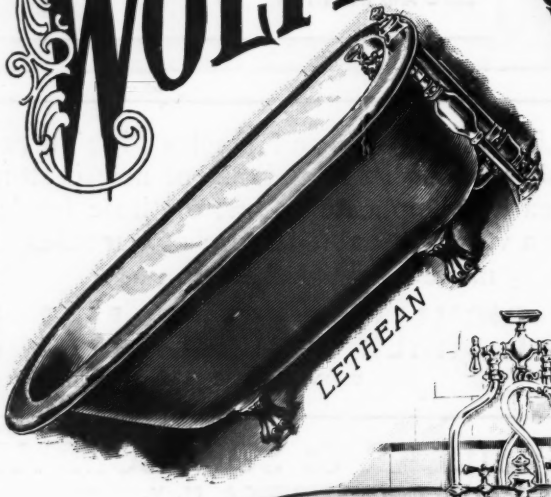

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